

THE SCOPE

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CAPSTONE

Aindra Tan - Morality Police and Self-Determination in Iran

Neal Patel - Optics and Oppression: The Lavender Scare's Consequences on Queer America

Oliver Qi - The Mosaic of Sameness: Ambiguity and Conformity in College Admissions

Angelina Xu - The Dark Shine of Mica: Hidden Exploitation

Stephanie Liu - "Treat These People Like Cattle": Challenges and Resistance to ICE in the 21st Century

ALASKA TRIP

An Ecological Baseline Study of Black Bay, Herbert Graves Island, and Kukkan Passage, Alaska

ARJUN MAGANTI

Co-occurrence of Extreme Heat and Pollution in the Southwest United States

SCIENCE IN THE NEWS ARTICLES

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A Letter from the Editorial Team

Welcome to the Sixth Edition of the Scope! After a highly successful edition last spring, we are extremely excited to announce the last publication in the 2024-25 school year. This will also be our fifth edition since transitioning to an interdisciplinary research journal, and the fourth edition with articles written by our own editorial board about important and fascinating recent advances in both STEM and humanities. Our journal continued its unprecedented growth this year, and we're excited to welcome the many new additions to our editorial team, who have brought a variety of new ideas and writing to our journal.

We wanted to give special thanks to the array of research projects we have been able to accept this edition, which included many amazing projects. We'd like to extend special thanks to Mr. Meyerowitz and the Existentialism and the Absurd Capstone class for allowing us to publish their work, and we're excited to announce that we will also get to publish the paper from our school's trip to Alaska last year! Congratulations to all of the students on their fantastic work; the editorial team wishes all the authors the best of luck in their future research endeavors!

As for the rising high school students, we're excited to be a part of your journey in exploring your potential and applying your learning to further our world. We've seen so much growth in the paper this year, and can't wait to see what happens next year. We aim to continue our mission of showcasing the amazing talent at our school while inspiring others to take part. We hope to lead the way and encourage our Bobcats to eagerly share and contribute their research in order to help benefit and introduce others to the possibilities beyond just what we learn in class. Leaving you with these wishes, the editorial team will see you again after the New Year!

Always looking forward,

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Science In The News

iDOMO: A Novel Computational Framework For Designing Cancer Treatment Drugs

Aanya Gupta

iDOMO (Identification of Drug Combinations via Multi-Set Operations), is a novel computational framework designed to predict synergistic drug combinations for treating complex diseases like cancer. Unlike traditional experimental methods that are expensive and time-consuming, iDOMO leverages large-scale transcriptomic datasets of drug perturbations—such as those from the Connectivity Map (CMap) and the LINCS project—which contain gene expression data from drug-treated cells. iDOMO compares gene expression signatures from diseases and drugs, using a set-theoretic approach to assess how well a combination of two drugs can reverse the molecular effects of a disease. It categorizes overlaps between gene sets into beneficial (disease-related gene expression changes that drugs can reverse), harmful (changes that mimic the disease), and neutral. From these categories, it calculates two main scores: the Total Drug Combination Score (TDCS), which reflects the overall benefit of the combination, and the Combination Synergy Score (CSS), which accounts for the individual effects of each drug, allowing researchers to distinguish combinations that are truly synergistic from those that merely add up the effects of the two drugs.

The researchers at the Icahn School of Medicine at Mount Sinai rigorously tested iDOMO against other drug synergy prediction methods, including Therapeutic Score (TS) and SynergySeq Orthogonality Score (OS), using benchmark datasets like the DREAM Challenge and large drug combination repositories (DrugComb and DrugCombDB). Across multiple cancer types—including breast, prostate, colorectal, and lung cancers—iDOMO demonstrated superior predictive accuracy, as measured by metrics like concordance index and Spearman correlation with experimental synergy scores. The method was then applied specifically to triple-negative breast cancer (TNBC), a highly aggressive cancer subtype lacking targeted therapies. iDOMO identified the combination of trifluridine and monobenzone as the most promising. This prediction was validated experimentally using the SUM159 TNBC cell line, where the combination showed strong synergistic inhibition of cancer cell growth, especially at lower doses. The study not only underscores iDOMO's practical utility for in silico drug discovery but also highlights its potential to significantly accelerate the development of combination therapies by narrowing down promising drug pairs for experimental validation. Future work will focus on expanding iDOMO's application to other diseases beyond triple-negative breast cancer, further refining its predictive capabilities, and integrating it into broader drug development pipelines.

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Approaches to AI-Enhanced Research Article Summarization in Computer Science

Vedh Reddy

Structured Synopsis to Understand and Contrast

One of the notable strategies that AI-based summarization has adopted is the development of organized abstracts that explicitly separate a research paper's issue, methodology, and contributions. Its aim is to make technical research quickly understandable and to make comparisons between different studies. Projects like CS-PaperSum and BigSurvey demonstrate this paradigm by using algorithms like ChatGPT or custom transformers to summarize roughly 100,000 computer science papers that were published in top computer science venues.

The effectiveness of this method is largely due to its scalability and relative transparency. For instance, systematic design of CS-PaperSum supports the meta-analytical study of artificial intelligence research trends in areas like multimodal learning and retrieval-augmented generation. However, these abstractions are likely to meet challenges when representing sophisticated or interdisciplinary contributions, and are highly dependent upon generalizability of large language models trained over massive datasets. By contrast, structured methods that include expert-annotated hierarchies, like BigSurvey's CAST model, offer more nuanced taxonomies (e.g., subfield hierarchies), making them more useful for literature reviews. Still, they risk obsolescence as research fields evolve, unless continuously updated.

Citation-informed summarization with increased contextual richness.

Another approach focuses on citation-based summarization, with the assumption that the way a paper is cited indicates its main contributions. Such concepts are made operational by citation-based database systems like ScisummNet, where citations are linked to the targeted text and used to make a summary. This method is compelling for its grounding in scholarly reception, offering summaries that reflect how a community values certain findings. It's especially beneficial for identifying a paper's long-term impact. However, this strategy may overlook newer or under-cited work, introducing bias toward well-known publications. Moreover, citation behavior can vary significantly across fields, meaning this method isn't equally effective everywhere.

Abstractive vs. Extractive Tradeoffs

A key area of difference is that between extractive and abstractive summarization methods. Abstractive methods, like the CS-PaperSum, create new sentences that reformulate the source text, simulating the way humans summarize. This method offers both flexibility and readability, particularly to readers with different areas of academic background. But with this method also comes the danger of hallucinations—where a summary includes content that the source text never contained.

On the contrary, extractive approaches, such as parts of ScisummNet or standard NLP pipelines, directly sample sentences from the source text. Though more source-text-consistent in general, such methods tend to have less readability and cohesiveness. In contrast, many modern datasets adopt a hybrid approach, where textual components are first extracted and later fine-tuned by generative components to make the text more fluent but less accurate.

Comprehensive Stratified Summarization to Achieve Depth

Modern projects aim to capture all aspects of scientific work by applying multi-faceted summarization where research is grouped under headings like motivation, technique, findings, and conclusions. Such a method is applied by projects like BIGSURVEY and MASSW to give an overall synopsis of research that is notably useful to policy-makers, educators, and researchers in different fields.

Despite the highly useful nature of multi-aspect summarization, execution and evaluation are extremely complicated. In addition, there is a risk of oversimplification since rigid category distinctions do not necessarily capture the dynamic nature of authentic research narratives. However, these approaches offer one of the most promising paths to AI-assisted knowledge advancement, especially when combined with trend analysis tools.

In the end, some datasets focus solely on extreme summarization, reducing a paper to a couple of sentences, otherwise known as a TLDR. Projects like SciTLDR take this approach with concise overviews that make quick screening possible.

Even with their convenience, TLDRs risk glossing over crucial subtleties. A single phrase might not distinguish between a breakthrough and a moderate improvement. However, TLDRs function well as useful orienting tools, especially for the nonspecialist, or as appendages to systematic and thorough summaries.

Conclusion

AI summarization of scientific papers is evolving rapidly, balancing between scale, depth, and accuracy. Structured and multi-aspect approaches enhance interpretability, citation-based summaries provide context, and short-form methods improve accessibility. However, no single method is ideal. The future likely lies in hybrid systems, integrating the reliability of citation analysis with the readability of abstractive summaries, supported by constant evaluation and domain-specific tuning.

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Molecularly Functionalized Biomass Hydrogels for Sustainable Atmospheric Water Harvesting

Iris Li

Recently, a team of researchers at UT Austin created a sorbent that can pull drinkable water out of the air. The sorbent is made with everyday scraps and natural materials such as food scraps, branches, seashells, etc. This discovery opens the path for a new ideology for sustainable water collection, using everyday natural materials that can transform into high-efficiency sorbents, as well as a solution for water scarcity.

During tests, the team generated around 3.75 gallons of clean water per kilogram of sorbent daily. Most sorbents can generate between 1 and 5 liters per kilogram per day. The research provides a new way of designing sorbents, as almost any type of biomass can be used. The team's sorbet is biomass-based hydrogel, which is biodegradable, scalable, and doesn't require much energy to release water, while existing sorbents use petrochemicals and require higher energy inputs. They used a new two-step molecular engineering process that gives hygroscopic(tending to absorb moisture from air) properties and thermoresponsive(exhibiting changes due to temperature changes) behavior to any biomass-based polysaccharide(ex. Cellulose or starch).

Currently, the team is working on scaling production and designing devices for commercialization of the sorbent, such as portable water harvesters, self-sustaining irrigation systems, and emergency drinking water devices. Since the research's inception, the team had been focused on scalability in hopes of translating the research to be able to be used for real-world problems around the world. Their sorbent, which is feasibly fabricated with widely available biomass, provides us with insight into future solutions for water scarcity.

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Dopamine Quantification Through Metal Oxide Carbon Nanotube Modified Electrodes

Allyson Yu

Many neurodegenerative diseases are characterized by an abnormal amount of dopamine, a key neurotransmitter commonly referred to as the "feel-good hormone", present in the brain. Dopamine plays a significant role in common human emotions like pleasure and happiness, and an insufficiency or excess often indicates a neurological disorder. There are pre existing methods of quantifying dopamine levels like mass spectrometry and high-performance liquid chromatography (HPLC), which use mass-to-charge ratios and absorbance to characterize molecules, respectively. However, the cost, sample preparation standards, and time needed to retrieve data from these machines are unfavorable. Instead, other methods have been or are being developed to efficiently mediate measurement of dopamine levels. Electroanalysis and reduction-oxidation (redox) quantification, specifically those that utilise nanoparticle-based sensors, have become of interest and are promising in this field. Recently, discoveries were made by Hassan and coworkers in using nanocomposite manganese-copper bimetallic oxides as chemical probes to quantify dopamine selectively and accurately.

The nanoparticles were created through homogeneous mixtures of copper sulfate and potassium permanganate crystals with chemical vapor deposition (CVD) synthesized carbon nanotubes.

Following quantification of the dopamine-bimetallic oxide redox reactions using the Randles–Sevcik equation, there was a noticeable improvement in the active surface area covered by the nanocomposite covered electrodes opposed to original screen-printed carbon electrodes (SPCE). Additional testing using cyclic voltammetry (CV) revealed enhanced oxidation of dopamine when comparing the modified to the unmodified electrodes. Specifically, modified electrodes that were annealed at 350°C revealed the highest oxidation peak current and thus sensitivity towards dopamine.

After finding the best temperature, the authors moved on to optimize other properties of the electrode by utilizing differential pulse voltammetry, or DPV. They found that at an optimal pH of 7.4, the phosphate-buffered saline (PBS) electrolyte, which plays a key role in mediating the redox reaction, led to the highest peak of oxidation current. They also discovered that after 30 seconds of accumulation, the dopamine oxidation peak current reached its maximum value.

With these optimized settings in hand, the authors then tested the DPV assay's selectivity towards dopamine. To do this, they ran their assays with not only dopamine containing samples, but also ascorbic acid and uric acid, both of which are easily oxidized compounds that have similar redox potentials to dopamine. They found that, despite these similarities, the DPV signal was dependent only on concentrations of dopamine and not the other two compounds. This indicated that their DPV assay was a selective and good method of quantifying dopamine levels through the nanocomposite-modified electrodes.

Finally, the authors tested their discoveries in pharmaceutical dopamine-containing samples, where they were able to recover over 90% of dopamine. Not only does this introduce a novel and highly accurate method for quantifying dopamine levels, but it also suggests the possibility of future quantification analysis of different samples.

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AI and the Government: The Road to Make AI Research More Productive

Nelson Nishio

Within the past decade, the rise of artificial intelligence has undoubtedly allowed for significant advancements in virtually all fields of research. Hundreds of thousands of scholarly articles regarding artificial intelligence and machine learning are published every year. However, most studies only focus on theoretical models or benchmark datasets and do not extend far enough to produce useful products or practical policies that can be used in the real world. Meanwhile, policymakers and government bodies are constantly trying to make use of academic research to make informed decisions in practice, and they have to be extremely careful because of the high risk of making mistakes. But this is difficult with the current state—according to Mohamed Ibrahim [1], “public officials are often interested in deliverable products or demonstrable solutions, whereas academics are trained to funnel new knowledge into papers.” When academics are so focused on just providing an endless pile of raw information, it makes it difficult for people who are not experts on a field but want to make impacts to it (ie. policymakers and future researchers) to make the right decisions quickly. Ibrahim thus emphasizes the need for AI researchers to create real applications of their own in addition to their publications, effectively adding a step of converting “complex data, models and insights into user-friendly digital tools.” He explains that we can encourage more of this kind of

“solution-oriented” research if employers and funders transitioned from valuing unhelpful metrics like publication counts to more valuable “real-world impact” metrics. As an example, he says that citation counts can be used as they often translate to impact, and it indicates that other researchers found a proposed prototype or finding to be usable. If we start implementing a more “well-defined process for presenting and testing AI prototypes” that prioritize impact, we may be able to redirect the future of AI research to be more productive, ultimately fostering accessible collaboration between government officials and academic experts to make smarter decisions in legislation and improve the well-being of people.

Governments are recognizing the potential of AI in advancing the world, and are thus making efforts to advance AI research through massive public funding. In fact, the Biden administration recently pushed for \$3 billion in AI application development to be integrated in the 2025 budget [2]. But we can’t just blindly pump money into research without evaluating the resultant return from it. In their article, Julia Lane et al. [3] explains that we are lacking tools to measure the economic effects of the investments in AI research, and proposes that we look at people—not numbers of publications or patents—to understand the value in AI research. Their framework is the following: 1) Identify principal investigators (PIs) from academic conferences; 2) Track students, staff, and vendors connected to these PIs using university administrative data; 3) Follow their careers by using state employment and wage records, monitoring what happens when these researchers and students move into the private sector. What we find, as a result, is how AI is affecting the workforce (ie. creating jobs in various different sectors), how much AI workers are getting paid, and how investment in AI leads to more diffused knowledge and creates leeway for rapid innovation. There are, of course, concerns for privacy preservation as well as risks in bias for these metrics, but what matters is that we are making steps to ensure government funding is used optimally, and taxpayer money is going into productive use.

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In Defense of the Literary Canon

Simrat Walia

Recently, the debates about which literary works have merit and should be taught in academic settings have intensified. Specifically the concept of the literary canon itself, works traditionally regarded as the most important in shaping Western literature, is under scrutiny. Critics argue that it is exclusionary, outdated, and perpetuates systemic power structures. Furthermore, recent studies have shown that there has been a significant decline in recreational reading of literature in general (only 39% of surveyed adults), particularly the classics, as they are viewed as outdated and irrelevant.

However, the literary canon has strong merits that cannot be ignored. The canon helps us understand the cultural foundations of different societies, as well as some common values. Shakespeare, Austen, Milton, and Dostoevsky have remained relevant due to their addressing of

universal human experiences, such as love, power, and morality. These books aren't just valuable for academic development but also as a time capsule, providing insight into the changes and perpetuation of societal norms throughout history. When the world is becoming increasingly divided along political lines, the literary canon acts as an umbrella where various different philosophies can be debated in an intellectual manner.

Defending the canon doesn't mean that avant-garde literary forms and new voices should be discarded. Instead, it's important to recognize the importance of maintaining intellectual standards. Studying so - called 'boring' texts allows for increased thinking and analytical skills. The interpretation of these works can provide a foundation for understanding more modern works. Many argue that the canon has historically underrepresented marginalized groups, which is true. However, this shouldn't mean it should be immediately abolished. As time has advanced, more diverse voices have been added to the canon, such as Virginia Woolf, and the diversity of perspectives seen in the winners of the Nobel Literature Prize in the past few years. The canon should be encouraged to evolve, allowing for a more thorough and well informed perspective of all voices.

Defending the literary canon isn't about being outdated or clinging stubbornly to tradition. It's about acknowledging the value of works that have shaped cultural/intellectual society. These works can provide some solace, something to look back to in times of turmoil and change. These works aren't just outdated burdens for students to ponder over for their AP Literature exams. They serve as a reminder of our shared humanity and timeless questions.

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AI and Physics — How Images are Created

Fred Sun

Ask ChatGPT to generate an image of anything for you; a flying cow, a toucan reading a book in a pirate ship, etc. and it will do so swimmingly. How can it do that? As is well known, AI is trained on a large amount of data so that with each new version of that AI its responses will better match that data. But surely ChatGPT was never shown an image of a toucan actually reading a book. To do that, it needed to be able to adapt — it needed to take into account what it knew about toucans, what it knew about books, and what it knew about pirate ships, and combine them and change them accordingly to be able to create a complete picture of the scenario. To do so, many new AI algorithms use ideas in physics in order to adapt to new scenarios.

Think about what happens when you pour milk into water. As soon as the stream hits the water, it will go out in all directions and puff out, spreading throughout the water. This process is called diffusion. It's the same process that governs how our cells intake nutrients, how heat conducts, and how sugar cubes in coffee dissolve. The respective partial differential equation is solvable, with elementary solutions, and is based on probability theory, i.e. the likelihood of the motion of any single milk particle, then taking an average to find the total behavior of the milk. So it's well known what will happen with the milk after we pour it into our water. Notably, it also has an element of randomness. The laws of physics tell us that particles undergo probabilistic motion; the solutions to the equations are what is expected given a large set of particles. So a diffusion model trains an AI to identify and decode randomness (called denoising) from a text prompt, adapting to that prompt, to

produce an accurate image. This process is gradual; the AI slowly denoises in order to preserve the integrity of the original image and prompt. This allows for a much more natural and therefore realistic image. Specifically, its training is still based on many images, but each image is added with Gaussian noise functions (that promote randomness), for the AI to denoise. In this, it's like clearing a blurry or messed up photo, which AI's often produce. The AI is therefore not only trained on memorizing a collection of specific photos, but also on how to denoise. Physical models in nature have, fittingly, allowed creation of new models to be more natural and sound.

Noise is natural and often unavoidable in many instances. It's therefore imperative that we eliminate as much as possible. That's how we produce clear images. And it's an interesting precedent that in order to accomplish these computational tasks we can borrow methods directly from nature. It implies the possibility that solutions to other problems can be resolved by observations of nature, even if unclear at first. Ultimately, it's clear that not only a strong background on the subject at hand is necessary to progress on that subject; instead, it's always a good idea to connect other ideas in academia towards solving the problem.

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The Future of the Computational World: The Limitations of Quantum Computing and its Possible Implications in Research and Discovery

Jason Nishio

Quantum computing is one of the most rapidly evolving technologies today in the computational world. It is a relatively new, developing field and there have been many advancements in the past couple of years. So why did Jensen Huang, CEO of Nvidia, cause the quantum computing stock market to plummet with some shares decreasing up to 40% [1] by stating in CES 2025 three months ago that achieving “very useful quantum computers” could take between 15 and 30 years? In order to understand this, it is important to understand the complexity of quantum computing. The name itself suggests its complexity—it uses principles of quantum mechanics to “solve problems beyond the ability of even the most powerful classical computers.” [2] The essential idea is that quantum computers have the potential to process information at speeds orders of magnitude higher than the best traditional, classical computers. The main principles of quantum computing that allow for this exponential difference are superposition, entanglement, interference, and measurement. Quantum computing utilizes qubits instead of classical bits in its computations—classical bits can only exist as either 0 or 1, while qubits can exist as 0, 1, or a “superposition” of 0 and 1. While classical computers compute every step of a calculation one by one, quantum circuits can make computations at the same time, saving an astronomical amount of time. This is why quantum computing is seen as the “future” of the computational world.

However, quantum computing is not very simple to actually apply. In principle, quantum computing may seem like the remedy to all of our problems, but it is actively being rigorously researched and improved. There are many challenges that current researchers are facing in the development of quantum computing technology. Fundamentally, the main limitation is the instability of qubits—qubits can be influenced heavily by environmental factors such as temperature fluctuations and electromagnetic interference, which can cause the qubits to fall into a non quantum state. This phenomenon is known as decoherence^[2]. State of art quantum gates produce much larger

error rates than logic gates, so there is a need to develop error correction technology^[3]. Also, qubits can only maintain their quantum state for a limited amount of time, which limits the computation time and benefits that the technology can provide. Additionally, there is a limited number of quantum algorithms and code availability, while there is currently rapid development of quantum programming languages like IBM Qiskit (which I have worked with), Q#, and Python. There is a limited number of experts in the field, as research in quantum computing requires extensive expertise in quantum physics, computer science, and engineering. Research in quantum computing is highly costly and requires extremely specialized environments with expensive quantum computers and extreme physical environments for qubit technologies to operate correctly. The list of limitations in current quantum computing technology goes on, which is why Jensen Huang is not entirely wrong that practical and useful quantum computers are not something that seems will be achieved in the near future.

Quantum computing undoubtedly has the potential to revolutionize computation. It can lead to rapid emergence of groundbreaking discoveries and research—in virtually anything requiring computationally expensive tasks, like drug discovery or catalyst design through computational modeling of biological processes and molecule interactions^[4]. Quantum computing can make machine learning tasks significantly faster, which can increase the speed in training models and lead to rapid development in significant discoveries in developing artificial intelligence frameworks for tasks that can be automated in essentially any discipline, such as biomarker discovery, disease detection, sarcasm detection, or prediction of stock market price progression. Most industries in the modern world rely on some form of computation, and quantum computing can revolutionize advancements in a myriad of fields and disciplines. Although quantum computers will not replace classical computers in its universal everyday use, it can lead to cutting-edge discoveries in research. Hence, although quantum computing is a relatively small field today, because of its known massive potential, it is indubitably the future of modern research and we are yet to see the rapid emergence of a new, significant field. Here is some more readings about quantum computing if you are interested: “[Breakthroughs in Quantum Computing](#)” (published 19 August 2024), which talks about recent advancements in quantum computing, such as molecular structures and quantum simulation, spin waves, and Shor’s algorithm, and “[Here’s what Nvidia CEO Jensen Huang said about quantum computing, Project Digits and robotics](#)” (published 8 Jan 2025), which details more about Jensen Huang’s comments and viewpoints on quantum computing and why he thinks that way.

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Genetically Engineered 'Woolly Mice' Mark Breakthrough in De-Extinction and Climate Adaptation Research

Rishaan Pabbisetty

A Dallas-based biotechnology company called Colossal Biosciences made news in 2025 when it produced genetically altered mice that resembled the extinct woolly mammoth. These "woolly mice" are a component of the company's larger objective of de-extinction, which is the reintroduction of extinct species through contemporary genetic technology. Because of their short gestation periods, quick reproduction, and the wealth of scientific information about their genetic makeup, mice were selected for this experiment. Starting small allowed scientists to hone methods that could eventually be applied to larger mammals, such as elephants, which are mammoths' closest living relatives.

The long, thick, and wavy coats of the woolly mice were designed to mimic the insulating fur of woolly mammoths. Because of this adaptation, the mice are better able to retain heat, which is essential for survival in cold climates. The mice were also altered to process fat more effectively, which is another characteristic of species that have adapted to cold temperatures. By introducing particular elephant and mammoth genes into the mice's DNA, these alterations were made, illustrating how precise genetic editing can result in striking physiological changes.

This discovery represents a significant advancement in synthetic biology. It demonstrates how scientists can successfully recreate traits that vanished thousands of years ago by fusing genes from extinct species with those of living things. The development of woolly mice offers a useful testing ground for methods that could eventually make the resuscitation of an actual woolly mammoth a reality, even though that objective is still a long way off. By introducing advantageous traits from other animals, the success of this project also creates opportunities for applying similar strategies to assist endangered species in adapting to climate change. Essentially, the woolly mouse represents a minor but noteworthy turning point in the development of humankind's capacity to use science to alter the natural world.

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An Ecological Baseline Study of Black Bay, Herbert Graves Island, and Kukkan Passage, Alaska

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Ecological benchmark studies are critical in establishing and pinpointing specific threats in the environment and facilitating conservation and preservation efforts. Baseline studies, in particular, are particularly relevant as studies have never before been conducted in the evaluated regions. In this paper, we present an ecological baseline study of Black Bay and surrounding regions in southeastern Alaska during the period June 1 to June 7, 2024, with the goal of evaluating biodiversity and providing a thorough species count. Data for each specific facet of the environment, including birds and terrestrial invertebrates; botany and mycology; fish and marine invertebrates; geology; land and terrestrial mammals; and marine and riparian mammals; were recorded separately. The methodology involved counting species using transect, point, and grid surveys. Identification apps and field guides were used to identify species. This study identified a large variety of species, as the regions surveyed have very high biodiversity. The data provides a snapshot of the current environment in Black Bay, Herbert Graves I., and Kukkan Passage, and will allow future researchers to analyze changes in the areas studied, whether related to climate change, habitat destruction, or other phenomena.



Existentialism and the Absurd Capstone Papers

Morality Police and Self-Determination in Iran

Aindra Tan

“The improperly veiled woman is a stain on the Islamic Republic of Iran who must be eliminated immediately.” This slogan is one of many that were plastered across the walls of public places during after the Iranian Revolution, when religious revolutionaries overthrew Iran’s shah in 1979. Since then, it has been mandatory for all women to meet a specific dress code, which most notably includes the hijab. The Guidance Patrol, also known as the morality police, was founded in order to enforce this mandate (Ghaedi). Women who do not comply with it can be subjected to fines, jail time, being whipped, being banned from workplaces, and even being sent to mental institutions (Parent). The morality police are often abusive in their treatment of “offenders,” and apply this force very inconsistently. Although modesty laws and their enforcement by the morality police have severely limited the self-determination of Iranian women in absurd and arbitrary ways, they have still found both overt and covert methods of resistance and civil disobedience.

When authorities are given absolute power over individuals, actions lose inherent meaning; instead, meanings are assigned on the whims of these authorities. In *Catch-22*, when Yossarian flies over a target twice, his superiors argue about court-martialing him, only to award him a medal and promote him to captain for his heroism (Heller). Whether or not an action is socially acceptable or unacceptable, moral or immoral, is not an intrinsic feature of the action, but a human decision that can change at any time. The same drastic shifts in meaning are apparent in the contradictory history of the hijab mandate. Traditionally, veiling customs have varied widely across different parts of Iran, and head covers were worn by both men and women. In the late eighteenth and nineteenth centuries, European influence led to the veil being seen as a symbol of oppression that needed to be abolished in order for women’s advancement to be possible, and as a result, it was abolished in 1936. Veiling then became a method of resistance against Westernization for Iranian women (Zahedi). In 1941, the shah abdicated, veiling was unbanned, and women had freedom in whether or not they wanted to wear it until shortly after the Iranian Revolution, when it was mandated (Uygur). Public opinion at the time was generally either apathetic or in support of the mandate; the majority of protests came from upper-middle-class women, who were either framed as Westernized elites or simply ignored by the Iranian media (Zahedi). These temporally close and primarily government-driven shifts in the perception of veiling highlight the absurdity of the institutions enforcing it. In an instant, the government can change the meaning of an action from a criminal offense to the inarguable standard for all women. The meaning of an action and its consequences for the actor can be completely reversed on the whims of authority figures; the average person has “no control over the meaning of the symbol and its institutionalization.” (Zahedi).

Even if the laws are rooted in governmental decisions rather than genuine moral standards, their consequences for women’s self-determination are very much real. Both women who preferred the hijab and women who did not were harmed by its mandate: “With the imposition of the Islamic dress code, veiled women came to symbolize the image that the regime sought to project. Modern women became socially and politically marginalized, facing a contradiction between their own identity and the emerging ‘female identity’ constructed by the regime. They had to accept the image forced upon them in order to survive.” (Zahedi). Regardless of legal status, women can choose to

either veil or not veil. Whichever choice they make already has a government-assigned identity attached to it, whether that is the traditional, obedient housewife or the brainwashed, Westernized elite. Women, whether or not they comply with the laws, lose control over their image and identity. Many women do not fit neatly into these predetermined boxes, and as a result are ignored both in Iran and abroad. When more religious, conservative women who had always dressed in accordance with the dress codes protested against the mandate, they experienced the worst of both worlds—in Iran, they were attacked by the Guidance Patrol as well, and outside of the country, they were “not supported by the secular and leftist organizations that in principle were in favor of women’s rights and social advancement.” (Zahedi). They did not fit the predetermined categories created by institutions, neither the ideal pious, submissive woman nor the ideal secular, progressive activist. Simone de Beauvoir’s *The Second Sex* highlights this issue of men defining the identities of women—“They propose to stabilize her as object and to doom her to immanence.” Their purpose in life has already been outlined by the patriarchal system before they have the ability to determine one for themselves. Under a government that blatantly states that “The worth of a woman is in her veil,” (Zahedi) possibilities for women to find individual purpose are few—“How can a human being in woman’s situation attain fulfilment?” (de Beauvoir).

In order to keep women compliant with modesty laws, the morality police dole out disproportionately harsh punishments on a rather arbitrary basis. We see this tactic in *Catch-22*: Major Danby is ordered to be shot to death because he was moaning, although everyone else in the squadron had been doing the same thing previously. His crime is completely disproportionate to the punishment, but institutions can use examples like these to keep the public afraid of dissenting and maintain control (Heller). The arbitrariness of enforcement is evident in the laws themselves: “There are no clear guidelines or details on what types of clothing qualify as inappropriate, leaving a lot of room for interpretation and sparking accusations that the ‘morality’ enforcers arbitrarily detain women.” (Ghaedi). An extreme example is that of Mahsa Amini, who in 2022 was detained by the morality police and beaten to death in custody for wearing her hijab “incorrectly”—not even not wearing it, but wearing it slightly too loosely. However, rather than incentivizing others to obey the laws exactly, the killing of Mahsa Amini had the opposite effect of widespread civil disobedience (Uygur). Even after this, the Iranian government continued attempts to “teach an example” through the persecution of randomly selected individuals and frighten the rest of the public into submitting. 15,000 protestors were arrested, and rumors quickly spread that all of them would be executed. According to Ali Vaez, the International Crisis Group’s Iran project director, however, “... they’re not going to execute them all. If the past is prelude, the regime is likely to cruelly execute a few to teach others a lesson and deter them from coming to the streets.” (Ioanes). The sheer randomness involved in the enforcement of modesty laws arguably delegitimizes them: how can one argue that veiling is such a vital matter of morality if the punishments themselves are clearly unjust? If all women who do not veil are immoral and deserve to be punished, why only punish a select few? The wide and inconsistent ranges of who is being punished, what they are being punished for, and what their punishment is are simply methods of control.

Despite these attempts at maintaining control, public outrage and protests in the wake of Mahsa Amini’s death continued, and took increasingly creative forms. Unlike historical protests, the 2022 demonstrations were heavily influenced by the Internet and international media (Uygur). Knowing this, the regime intentionally cut off nationwide Internet access for short periods of time, but due to the unsustainability of such cutoffs, they switched to banning specific apps instead. Every time one social media platform or virtual private network (VPN) was banned, protestors would simply switch to a new one, often with the assistance of diaspora communities (Kumar). More

traditional methods of protest, such as strikes and boycotts, persisted, and protestors were able to draw international attention to the crisis at unexpected times, like the Iranian men's soccer team refusing to sing the anthem during the World Cup (Ioanes). The men's soccer team's act of protest, as well as drivers blocking roads with their cars to protect protestors, illustrate the solidarity across social class and gender that formed as a result of the 2022 protests, unlike previous campaigns that were mostly limited to upper-middle-class women. Women cut their hair in public, not only defying the hijab mandate but also alluding to Persian folklore, where the cutting of one's hair is a symbol of sorrow. Fountains in Tehran were dyed red to symbolize the spilled blood caused as a result of the morality police (France 24). Long before the Mahsa Amini protests, women asserted self-expression in their appearance in more covert ways. They found loopholes in the laws, and found ways to dress that were far from the ideal standard of modesty, but still entirely legal. According to Iran's own parliament in 2018, "60 and 70% of Iranian women do not follow 'the Islamic dress code' strictly in public." (Ghaedi). "Young in Tehran" depicts some covert forms of resistance in action, from young people meeting at parks where they are less likely to be seen by the morality police to women wearing their hijabs loosely and closer to the back of their heads, where they could almost slip off (Effendi). Tighter, more colorful clothing grew increasingly common among young women, and many even wore translucent headscarves, which were technically legal but not at all in the spirit of the laws, almost like malicious compliance (Zahedi).

Although the laws themselves are yet to change, protests have placed pressure on the regime and revealed a stark gap between the beliefs of the government and those of the people. After around four months with no real change in laws, protests began to decline in scope, but seeds of doubt had clearly been planted among government officials. Attorney General Mohammad Jafar Montazeri told reporters of plans of "a possible halt to the activities of the 'morality police,'" leading to rumors that the morality police were being disbanded. These rumors were not realized, but the discussion reveals the protests were effective in getting the government to consider it (Zimmt). Violent crackdowns were unsuccessful in crushing protests like they had previously (Ioanes). Strikes and boycotts have had a noticeable effect on the economy (Zimmt). Even before the protests, "Young in Tehran" revealed the prevalence of milder forms of resistance among the youth in 2010 (Effendi) and Iranian government reports stated that the majority of women did not dress in line with the laws (Ghaedi). Since the protests began, going out without a veil has become increasingly socially normalized, and the laws have been enforced at a much lower frequency. When one woman decided to go to the airport without a hijab, she was shocked to see the majority of women there had done the same, and the security agents were saying nothing about it. "Our power is in numbers," she told the New York Times (Fassihi). The Guidance Patrol is an entity with many physical limitations, and with such widespread resistance across the general public, women are now able to easily break the modesty laws without being detained as they would have previously. Overall, "it seems that the regime is unable to deal with the roots of the protest, and that the widening gap between the state institutions and the public, and especially the younger generation, will continue to feed more manifestations of protest and even exacerbate them." (Zimmt).

Whether or not the modesty laws will be repealed in the near future is still a mystery, but the recent improvement of women's rights in another Islamic theocracy, Saudi Arabia, provide some level of hope for the future. "The laws on what women can – and can't – do in Saudi Arabia" by Elizabeth Carr-Ellis discusses several recent reforms regarding women's rights in Saudi Arabia—for instance, making it legal for women to access rights such as education or healthcare without a male guardian. Black abayas (a loose robe that covers the entire body) and niqabs (veils that fully cover a woman's face) were once mandatory, but a 2019 public decency law updated removed the mandate for abayas

and niqabs, instead opting to only require elbows and ankles to be covered. These reforms are part of Crown Prince Mohammed bin Salman's Vision 2030, a project emphasizing modernity and rejecting extremism. Such reforms may be possible in Iran in the near future—Montazeri's statements and arguments from members of parliament stating that the morality police "has had a negative impact on public attitudes toward the hijab and religion in general" are some clear clues (Ghaedi). However, Saudi Arabia's solution is a highly limited one. An authoritarian leader with no input from the people controls these laws, and even if one such authoritarian leader is making positive social reforms, a future authoritarian leader could just as easily revert them. Arguably, these reforms are just another example of authorities redefining standards as they wish. Ideally, change should occur at a grassroots level, where society as a whole is changing their social standards, not just a few individuals at the top of a hierarchy.

Modesty laws have effectively sorted women into two boxes: those who comply and veil, and those who rebel and refuse to. For decades, a woman's identity has been defined by which of these boxes she belongs to. However, civil disobedience has revealed a public rejection of boxes—the regime's framework of morality is clearly different from that of the people. Future research could look at how the enforcement of modesty laws on women differs from their enforcement on men, as men are also required by law to dress in certain ways, but there was little mention of the impact of male modesty laws in the sources covered here. As Iran's social climate evolves, morality as defined by authority and the methods they use to enforce it have only grown weaker. Ultimately, the law does not truly define who an individual is, or what morality is—all it can define is what is legal.

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Optics and Oppression: The Lavender Scare's Consequences on Queer America

Neal Patel

It's a recurring theme throughout history that institutions and the public quickly fall to mass hysteria and herd mentality when they have a scapegoat to blame society's problems on. Similar to the tide of transformation that occurs in Eugene Ionesco's play *Rhinoceros*, people forego their empathy and human connections in favor of letting propaganda tell them who to hate. In the early Cold War, the United States experienced a wave of conservative, anti-communist hysteria known as the Red Scare. Afraid of the spread of ideas that ran contrary to American values, politicians such as Joseph McCarthy went on a crusade purging the government and streets of "security threats". One group that faced particularly harsh penalties were homosexuals, who lost their jobs en masse in a wave of persecution known as the Lavender Scare (Haynes). The United States government's persecution of alleged homosexuality was an unnecessary overreach of power specifically designed to play on the nation's patriotism, and it came back to bite them when those they attacked were radicalized, resulting in the spread of the very "problem" they were attempting to contain.

The 1950s had the U.S. government purposely scheming to inflate fears of homosexuals, framing them as "other" and "un-American". Prior to the Cold War, while the general population of the country didn't like queer people, they weren't actively trying to expose them. Prejudice was mostly based on fear of the unknown, something that politicians took advantage of to shape the narrative. In her article "The Lavender Scare and Empire: Rethinking Cold War Antigay Politics", Naoko Shibusawa brings up Republican representative Arthur L. Miller's speech to congress on March 31st, 1950: "A physician by training, Miller deployed an anatomical metaphor, diagnosing that 'the fetid, stinking flesh . . . [on] this skeleton of homosexuality' posed a serious threat to the nation's well-being." Miller leveraged his professional training to give credibility to his beliefs, filling in the gaps in people's knowledge with superstition. The "anatomical metaphor" served to distance homosexuals from "normal" people in the minds of the public, making them seem alien and dangerous. When people aren't seen as people anymore, it's harder to empathize with them, and far easier to trample over their rights. With queer people set up in the public's eyes as fundamentally immoral, the next step the government and media took was correlating their "sexual immorality" with America's greatest enemy: Communism. In "Americanism, Un-Americanism, and the Gay Rights Movement", Simon Hall elaborates on how the media portrayed homosexuality as a precursor to communism, something that weakened the spirit and let in evil, destroying America from within, bringing up how "journalist Arthur Guy Matthews even claimed that communists were seeking to convert America's youth to homosexuality in a bid to defeat the United States from within. Homosexuality, he said, was 'Stalin's Atom Bomb.'" By framing America's queer population as an at-home substitute for the fear of dangers abroad, the media and U.S. government gained a powerful scapegoat for enforcing anticommunist rhetoric. They could "crack down on communism" at home for easy optics, while facing no pushback since the groups they were attacking were already viewed as immoral. Anyone who saw something wrong with the persecution of queer people wouldn't be able to speak out about it, lest they be seen as a communist sympathizer.

The firing of suspected homosexuals served to publicize America's strengths and attack its enemies, setting a clear example for the rest of the world. The Lavender Scare, despite revolving around a topic considered taboo, wasn't a stealthy affair. Under Executive Order 10450, between 5,000 and 10,000 suspected homosexuals were fired from their government jobs, and blacklisted from

all future work in the civil service (Haynes). While politicians disliked talking about suspected homosexuals, government departments often advertised their “purity” as a sign of loyalty and strong leadership. And while the process of firing personnel was generally kept quiet, they made sure it was clear that former employees knew the reason for their termination. One such employee was Jamie Shoemaker: “they said ‘we understand you’re leading a gay lifestyle.’... It was made clear to Shoemaker that he couldn’t keep his top secret security clearance, and he was taken to a nearby facility where he was separated from his fellow employees” (Haynes). Although there were protections at the time for unlawful firing, they didn’t apply to homosexuals. And while the NSA took extra precautions when it came to firing someone with security clearance, this is also an example of the government wanting someone to know why they were fired, wanting others in the department to know why they were fired. Expanding our view a bit, another aspect of the Lavender Scare that’s not often touched on is how it tied into international politics, outside of being an American overreaction to communism. At the time, the U.S. wanted to appear as strong as possible to the rest of the capitalist, christian western world. One way they did this was by using as a representative of moral corruption on the other side of the globe. Returning back to the statements by representative Arthur L. Miller, “It is a known fact that homosexuality goes back to the Orientals... the Russians are strong believers in homosexuality, and that those same people are able to get into the State Department and get somebody in their embrace, and once they are in their embrace, fearing blackmail, will make them go to any extent” (Shibusawa). We should be focusing on how Miller paints homosexuality as a distinctly eastern, foreign concept. He’s blatantly fabricating information, since homosexuality was illegal under Stalin and the U.S. State Department never found any evidence of blackmailed queer people spying for the enemy. What Miller’s really doing here is taking the goal of this era’s anti-gay, anti-communist rhetoric to the next level. The USA is framed as the city on the hill, a shining example of christian, capitalist values like family, freedom, and loyalty. Meanwhile, communist countries in the east were seen as immoral and communist- the birthplace of a grave sin attempting to attack America. The lavender scare’s oppression didn’t come from just an internal cleanup, but through the signal it sent to America and the world that the government was taking a stance against what they claimed was immoral. Queer people in America stopped applying for government jobs, knowing it wasn’t safe. And governments abroad could see that America was in a place of strength, able to enforce its values, even if through the oppression of an innocent group of people.

While the Lavender Scare was intended to send homosexuals underground, it may have unintentionally sped up the development of the U.S.’s gay rights movements. The scare succeeded in ruining the lives of thousands of queer people unfairly ousted from government jobs, but the government didn’t count on the fact that there’s only so much abuse a group can take before they snap back. In Albert Camus’s *The Rebel*, he claims that “The rebel simultaneously experiences a feeling of revulsion at the infringement of his rights and a complete and spontaneous loyalty to certain aspects of himself. Thus he implicitly brings into play a standard of values... that he is prepared to support it no matter what the risks.” Up until the purges, queer people in America weren’t free to do as they pleased, but they tolerated the passive oppression as an immutable fact of life. If you were gay, you hid it. But as Camus puts it, eventually things go too far, and people aren’t going to take it anymore. When faced with the systematic attacks on their livelihoods, they found that “spontaneous loyalty to certain aspects” of themselves, and many queer people in the U.S. were radicalized. They decided to fight for the right to live their lives, “no matter the risks”, and kick-started what would eventually become the queer rights movements we’re more familiar with today. Some of the most outspoken voices of the early homophile organizations were those who had been fired from government positions. They’d climbed the ladder, only to have it yanked out from under them. One such voice was Frank Kameny, a former astronomer for the U.S. Army Map Service who was

interrogated and fired for his sexuality. He spent the next 50 years fighting for gay rights, becoming synonymous with the movement. As he put it in his interview with Making Gay History, when hearing interviewer Eric Marcus refer to him as a radical, “I have had cases over the years that I’ve handled of meek, mild, unassertive, un-aggressive people who just want to go about doing their work... They are trampled upon with a hob-nailed boot and suddenly it does exactly that: it radicalizes them. And off they go marching militantly.” Kameny just wanted to do his job. But his and others’ treatment by their own government was the last straw, and turned a closeted civil servant into a champion for radical change. Kameny would go on to help found the Washington D.C. branch of the Mattachine Society, one of the nation’s first militant gay rights organizations, and would be instrumental in the removal of homosexuality as a mental disorder by the American Psychiatric Organization (Marcus). He worked with other homophile groups like ONE Inc. and the Daughters of Bilitis to try and de-mystify the nation’s perception of gay people, making instrumental progress in bringing a tentative end to the Lavender Scare. Even after their tactics began to backfire, the federal government wasn’t going to just let these groups’ public “immorality” slide. The Mattachine Society and ONE Inc. were under constant surveillance by J. Edgar Hoover’s FBI, who were intent on shutting down their publications on charges of obscenity. From Douglas M. Charles’ article “From Subversion to Obscenity: The FBI’s Investigations of the Early Homophile Movement in the United States”, “FBI officials sought to silence ONE by developing an obscenity case that, if successful, would have put the organization out of business...ONE magazine won its legal case, which... opened the door for ONE and all contemporary and subsequent gay publications to be mailed to interested recipients.” The FBI’s tactics backfired, as not only did Hoover’s personal crusade result in no charges being levied against ONE, but it led to the justice department setting precedent for the distribution of the so-called obscenity. Now, it would be misleading of me to not mention that in their earliest days, ONE and the Mattachine Society did have ties to communist sympathizers. But ironically, the FBI investigations into them helped the movement realize they could further their message if they tied it to American concepts of freedom and self-expression, and lead to a severing of ties (Charles). So, in a plot twist, the U.S. government accidentally accelerated the publicity of the very people they were intending to cover up, and failed to maintain the conditions that allowed for the Lavender Scare to continue.

Although individuals and organizations reached a tentative solution to the Lavender Scare, similar sentiments still pose a threat to liberties today. Gay rights have come a long way since the 1950s. Marriage equality, being able to adopt children, and employment protections are all examples of ways how we’ve progressed, and from a surface perspective the problem of equality has been “solved”. However, there are still limitations to this equality from institutions in power, a big example being the second term of President Donald Trump. From the ACLU article “Trump’s Executive Orders Promoting Sex Discrimination, Explained” by Gillian Branstetter, it’s explained that “Trump’s order then directs federal agencies to “enforce laws governing sex-based rights, protections, opportunities, and accommodations” using his cramped definitions... The order also includes a sweeping mandate to all agencies to “end the Federal funding of gender ideology.” Transgender people make a great scapegoat for the federal government today, just as homosexuals did back in the 1950s. Much of the population doesn’t understand the concept, allowing for populists to fill the gaps with prejudice. By defining gender as a binary in the eyes of the government, Trump gets an easy victory, able to act like he’s serving the morals and values of conservatives while demonizing a group that has no say in their depiction, yielding a result similar to the Lavender Scare. The Trump administration’s similarities to McCarthyist purges of queer people don’t end there, though. His 2024 campaign largely revolved around cutting “DEI” (Diversity, Equity, and Inclusion) out of the federal

government in the name of increasing efficiency. According to Alexandra Olson and Zeke Miller in their Associated Press article on the topic, “Trump’s executive order will toss out equity plans developed by federal agencies and terminate any roles or offices dedicated to promoting diversity. It will include eliminating initiatives such as DEI-related training or diversity goals in performance reviews.” Populism works best when the public doesn’t know a topic’s specifics, only that they should hate it. DEI has become conservative slang for any employee who isn’t a straight, white male, and even then it’s used to describe anyone who doesn’t go along with the administration’s vision. Trump gets more easy press purging “DEI” from the government all while cementing a more limited and conservative worldview within the bureaucracy. Trump’s McCarthy-like purges only serve to carry on the cycle of scapegoating people and concepts the public doesn’t fully understand, in a cheap effort to look good and mask his real agendas, just like how Arthur L. Miller once did during the Lavender Scare.

The Lavender Scare was an attempt at using the nation’s queer population as an effigy for the fear of communism and immorality, but it ended up shooting itself in the foot as the people it oppressed worked to spread awareness and fight for their freedoms. It was a solution to that era’s problems, but today we face a new variety of the same formula of threats. Returning to Eugene Ionesco’s *Rhinoceros* gives us one last piece for our perspective. The book’s characters transforming into rhinoceroses and stampeding through the street resonates with the government and public getting whipped up in a frenzy and abandoning their critical thinking, giving in to hysteria and herd mentality, quite literally trampling the rights of those different to them. Just as a *Rhinoceros* might charge something strange and unfamiliar, so too did those involved in the Lavender Scare, and so too do right-wing media and voters today. But ending on a less dreary note, there is a chance for change. We have to remember that unlike *Rhinoceros*, these backswings into conservatism don’t have to be permanent, that we don’t have to be trapped under institutions’ systems of oppression forever. The Lavender Scare was ended by people willing to not back down when faced with overwhelming institutional prejudice, and the same could one day be said about today’s issues, as long as people don’t give up fighting against being defined by those who hate and fear them.

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The Mosaic of Sameness: Ambiguity and Conformity in College Admissions

Oliver Qi

January 1st, 2025. That evening, I, along with hundreds of thousands of high school seniors across the country, sat anxiously in front of our computer screens, eyes darting between activities lists, supplementals, and a clock that seemed to tick far too quickly. My laptop, already on life support from years of ownership, was now burdened by some fifty tabs of essay edits, all while my group chats exploded with frantic streams of panic—"Did you submit yet?" "Am I cooked for only having published one research paper in junior year?" "I saw someone get into Princeton with a meme as their essay." Here's a spoiler: BISV Class of 2025 all managed to submit our applications before midnight, though some of us cut it real close with just a few seconds to spare. As I submitted the last of my applications after the frenzy, I couldn't help but wonder how the admissions process, which was supposed to foster individuality and self-expression, had become a nervewracking maze plagued with second-guessing and last-minute edits. After all, for the past few months, one thing remained frustratingly clear: I didn't know exactly what these colleges were looking for. My thoughts have since led me to my guiding question: to what extent do elite college admissions in the United States reflect a power dynamic that thrives on ambiguity and encourages conformity? Through the lens of existentialism and the absurd, I aim to answer this inquiry, shedding insight on how the college admissions process reinforces a Catch-22 environment of uncertainty that discourages the very individuality they claim to uphold.

Despite the widespread notion that academic merit is conducive to success, the actual college admissions process is far more ambiguous than a meritocracy. According to an admissions statement by Stanford University, one of the most prestigious institutions of higher learning in the United States, the admissions process is governed by "holistic review," which means that "each piece in [someone's] application is reviewed as part of an integrated and comprehensive whole." Stanford, along with many of its peer institutions, views this approach as one that promotes individuality, as under holistic review, students are not judged by any single aspect of an application, such as grades or test scores, but rather by a combination of factors that reflect their "diverse backgrounds, talents, and experiences." However, while this system purports to value uniqueness, its subjective nature can often obscure the true criteria for admission. The recent high-profile Supreme Court case *Students for Fair Admissions v. Harvard* exemplifies this tension. Throughout the lawsuit, the plaintiffs argued that Harvard's use of race as a factor in its admissions process, while ostensibly aimed at supporting diversity, led to discriminatory practices against Asian American applicants (600 U.S. 2023). They claimed that Asian American students were unfairly penalized in subjective areas such as personality ratings, with evidence showing that students from certain minority groups held up to five times the advantage over Asian American students of comparable academic caliber. This revelation of what happens behind closed doors only adds to the crisis high schoolers face: the promise of an equitable admissions process contrasts starkly with the opaque mechanisms actually in place. Through this lens, we can draw parallels between the college admissions process and the bureaucratic absurdity of Catch-22. In Joseph Heller's novel, Yossarian and his fellow soldiers are trapped in a similarly vague system, particularly with the rule regarding being grounded from flying dangerous missions. According to the regulation, soldiers could be grounded if they were deemed insane; however, if they claimed insanity, they were deemed to be healthy as "concern for one's safety in the face of dangers that were real and immediate was the process of a rational mind" (58). Thus, through the comparison

with *Catch-22*, it is evident that applicants to elite educational institutions are also subject to absurd bureaucratic systems which promise fairness yet operate on vague and contradictory terms.

The ambiguity surrounding elite college admissions also reinforces power dynamics that extend beyond race, contributing to a growing number of students from wealthier backgrounds. According to a study by Sarah E. Dahill-Brown, which examined whether universities (University of Wisconsin-Madison as a model) are becoming more or less elite, the proportion of students from affluent families has steadily increased while enrollment from low-income households has stagnated. This trend is largely due to the association between academic merit and wealth, as students with more resources benefit from having more educated parents to guide them through the competitive admissions process. While this alone doesn't explain the shift, it does highlight growing barriers for lower-income students, particularly in an ambiguous admissions system where access to key information such as what colleges are looking for can put someone with that information at a considerable advantage. However, this advantage pales in comparison to the blatant manipulation uncovered in the Varsity Blues scandal. In a case that stemmed from the University of Southern California wealthy parents directly exploited their financial resources to secure preferential treatment for their children through bribery and fake athletic credentials, tactics far beyond the more subtle systemic advantages normally available to them. Leaked emails from *The Daily Trojan*, the University of Southern California's student newspaper, revealed that athletic officials like Alexandra Reisman discussed applicants' donor history as an admissions factor, including one whose family "gave \$20 million to a university in Canada," noting their "major potential" for future donations. Once again, we can draw a parallel to Joseph Heller's *Catch-22*, which, much like the college admissions process, features a vague and ambiguous bureaucratic system. Towards the end of the novel, the character Milo Minderbinder, who has made a fortune through deceit, uses his influence to convince Colonel Cathcart to let him avoid flying more missions, ultimately causing Nately to take Milo's place and die as a result. This pattern of the wealthy navigating ambiguous bureaucracies is clearly prevalent in the real world as well, a phenomenon that unfortunately results in those without such advantages being left to struggle within a system that seems almost designed to keep them out.

The lack of transparency in elite college admissions does not just maintain systemic inequality: it also allows for extreme conformity. At highly competitive high schools such as BASIS Independent Silicon Valley, students grappling with the uncertainty of college admissions criteria feel immense pressure to shape their profiles in ways they believe align with perceived institutional preferences. According to a survey I administered to 50 students from BISV, 86% of the student body has achieved state or national-level awards while 32% have had one or more research papers published in reputable journals, accolades that far eclipse the profile of the average high school student. Upon being asked about the motivation behind their accomplishments, 68% admitted their ambitions were at least partially driven by the rationale that "it would look good for college applications." A remark a student gave following the survey encapsulates this student culture perfectly: "There's always this feeling that someone else is doing more than you, and you don't want to fall behind" (A.K.) Beyond this pressure to conform academically, the subjectivity of holistic admissions also places undue emphasis on racial identity in ways that can feel reductive for students from underrepresented backgrounds. According to a multiracial student from the same survey, when they were asked to identify their race on their college applications, they strategically selected the race that *Students for Fair Admissions v. Harvard* revealed to be more underrepresented, even though they felt a deeper connection with their other heritage. As this particular minority group often carries with it the stigma of economic disadvantage, the student felt pressured to highlight this aspect of their background in their essays, reasoning that "it feels a bit wrong but if it'll get me admitted, I'll do it"

(Anon.). This situation reveals the extent to which race is commodified in the admissions process, where students from certain backgrounds are choosing to package themselves in ways that align with institutional expectations rather than their authentic selves, reducing themselves to checkboxes rather than complex individuals. Upon further introspection, this situation reveals yet another aspect of the aforementioned Catch-22, where affirmative action, which is supposed to give greater voice to underrepresented minorities, actually stifles authenticity in favor of predetermined racial narratives. According to a paper titled “Affirmative action and its race-neutral alternatives,” the author³ conducts an in-depth analysis which concludes that affirmative action increased underrepresented minority enrollment far more than any other race-neutral alternative would (20%). However, as aforementioned, while affirmative action remains the most effective means of boosting underrepresented minority enrollment, it also reinforces the pressure on students to conform to preset narratives, ultimately compelling the sacrifice of authenticity (which universities are supposed to value!) for the sake of fitting into arbitrary molds.

Whether it’s stifling individuality or perpetuating systemic inequality, it is evident that the ambiguity permeating the college admissions process has resulted in a system that ultimately undermines the very ideals it claims to uphold. The process that was supposed to celebrate unique backgrounds and self-expression has instead become an opaque system that gives preferential treatment to those who have the means to navigate its labyrinth. Yet this doesn’t have to continue. A possible solution in response to my recent observation of racial commodification lies in Washuta’s “I Am Not Pocahontas.” In the later portion of her essay, Washuta, who herself has struggled with her identity as a multiracial person of Native American descent who, unlike Pocahontas, couldn’t “paint with the colors of the wind,” rejects the reduction of her experience to performative labels. While she began the essay as someone who someone grappling with how others define her, by the end, she reserves the right to “keep herself whole,” by refusing to answer the question “How much Indian are you,” ultimately rejecting the institutional labels altogether. I’d imagine that if I were to propose this solution to the multiracial applicant who responded to my survey, they’d probably be concerned with how this would weaken their application and reduce their chances at the elite institution they applied to. And this leads me to my second solution: we should stop idolizing these elite institutions as if they’re the be-all end-all of higher education. We revere institutions such as MIT, Yale, and Columbia as the best paths for success; after all, they’ve produced successful alumni. However, previous research seems to contradict the notion that one’s alma mater has significant bearing on postgraduate earnings. According to an article published with the National Bureau of Economic Research, college selectivity has no statistically significant effect on success: rather, there is a higher correlation between an applicant’s standardized test scores and career earnings (Dale & Kruger). In other words, elite institutions tend to attract individuals with higher pre-college achievement (academics) and more robust social networks (wealth); it is perhaps not the institution that lends the applicant success but the other way around. Ultimately, by rejecting both the commodification of identity and the idolization of elite institutions, we can reclaim our narratives and redefine success on their own terms free of conformity.

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The Dark Shine of Mica: Hidden Exploitation

Angelina Xu

From sparkling eyeshadows and paints to semiconductors and lithium-ion batteries, mica is all around us whether we know it or not (Schipper et al.). Mica is a type of silicate material that is reflective, transparent, chemically inert, and temperature resistant, making it a common ingredient in electronics, paints/pigments, cosmetic, and automotive industries among many others. Mica also has a wide range of functions—in paints, it's used to prolong shelf life, insulate electronics, provide a "filler" in car bumper plastics, and give cosmetic products a glimmering effect ("Mica"). Yet behind such a lustrous material lies a dark and murky supply chain. India and Madagascar, the second and fourth largest exporter of mica respectively, have been confirmed to be guilty of child labor (Schipper et al.). On the backs of children, rests an industry worth \$576.1 million as of 2020 ("Mica Market | Global Industry Report, 2031"), and a total of 856,505 tons of natural mica (Schipper et al.). The global mica extraction industry, particularly in India, has long exploited vulnerable workers through systemic and illegal labor abuses, including widespread child labor; to remedy this civil society efforts and education programs have made progress in reducing child labor alongside the beginnings of a transition to more widespread usage of synthetic, lab-grown mica.

Mica miners, especially in Jharkhand and Bihar work in informal and illegal conditions, creating exploitative conditions where workers—many from marginalized castes—face low wages and limited alternatives for livelihood. Most Indian mica mining is concentrated in Jharkhand and Bihar, which are estimated to account for 25% of global mica production (Schipper et al.). With the expectation of two mines, all mines in Jharkhand and Bihar are illegal (Schipper et al.), leading to miners working in poorly managed environments. In a study conducted by the US Department of Labor, 70% of survey respondents reported being self-employed or working in familial arrangements. Such informal work structures make it difficult for the government to enforce labor conditions and sufficient pay for the workers. In the same study, it was found that workers in Jharkhand earn even less than minimum wage. For collecting 15-25 kilograms of mica per day, a worker would receive only 5-15 Indian rupees (INR) per kilogram, barely a maximum of 20 cents, making for a daily wage of \$0.90-\$4.50 USD, which could be less than the state minimum wage of 274.81 INR (\$3.30 USD). In an industry that falls below the line of sight of government enforcement, workers have little bargaining power to fight for fair wages. Compounding the meager pay that mica miners suffer from, the study described above also found that 57% of survey respondents were from the Scheduled Caste or Scheduled Tribe, previously referred to as "untouchables," rendering them socially immobile. Even with the abolition of the caste system in India, much of the stereotyping and discrimination still exists, resulting in systemic disadvantages. As one former miner from Jharkhand stated, "We are tribals, and people say that we are best suited for intensive hard work due to our adaptation to the local environment for generations" (United States Department of Labor et al.). This quote exemplifies the ongoing perception that marginalized communities are destined for hard labor, reinforcing a cycle of exploitation that denies them upward mobility. The deeply embedded social hierarchy, combined with economic necessity, forces many from the Scheduled Caste and Scheduled Tribe communities to remain trapped in mica mining, as they lack alternative employment

opportunities, despite the enormous physical toll and the dangers associated with mica mining. As one miner explained for Reuters, “I know it’s dangerous, but that’s the only work there is.” This sense of entrapment mirrors Albert Camus’ interpretation of the myth of Sisyphus, in which a man is condemned to push a boulder up a hill for eternity, only for it to roll back down each time he reaches the top, and thus the cycle repeats. Like Sisyphus, mica miners in Jharkhand and Bihar are caught in an endless cycle—forced by poverty, societal constraints, and lack of job alternatives to perform the same grueling and dangerous labor day after day, with no real prospect of escape—while the pay that miners receive is nowhere near enough to ensure a decent living or better their conditions, it’s oftentimes the difference between going hungry or not. In an interview for Refinery29, Pooja Bhurla says, “I come here every day...if I don’t work, how will I put food on the table?” Their endless toil is a symbol of Sisyphean absurdity, a repetitive and taxing existence characterized by a grim sense of purpose—to survive, they must earn a daily wage no matter how insubstantial it is. As Camus describes, “The workman of today works every day in his life at the same tasks, and his fate is no less absurd.” The wage earned is just enough to cover the most basic of necessities, but far from sufficient to break free from their infinite cycle of mica mining. No matter how many kilograms of mica are collected, they remain barred in the same destitution that necessitates their labor in the first place, sustaining this cycle to span generations.

Among these generations include the very youngest of society; limited access to education in Jharkhand, combined with the prevalence of child labor in mica mining, exposes children to dangerous working conditions that jeopardize their health and future, perpetuating a cycle of hardship from which escape seems nearly impossible. Schipper et al. estimate that 22,000 children in Jharkhand and Bihar are involved in illegal mica mining, with children as young as five years old witnessed heading into deep mines with a hammer and chisel in hand, working up to eight hours per day (Chandran and Nagaraj). Mining is far from a safe or stable occupation for children especially. Compared to other sectors, mining is by far the most dangerous, with a fatality rate of 32 children out of 100,000, compared to 16.8 out of 100,000 for agriculture (Schipper et al.). While the risk of fatality is high, higher is the risk of injury and illness. Just some of the risks of mica mining include abrasions, broken bones, scorpions, the walls and ceiling of the cavernous mines collapsing, and inhaling quartz dust that results in a persistent cough. Many workers, including children, contract asthma and black lung disease, increasing their risks of tuberculosis and cancer in the future (Münstermann and Werner). All of these health risks lead to mounting health costs, and to pay them, workers must keep mining (Münstermann and Werner)---a relentless loop that mirrors Sisyphus’s eternal struggle, where each effort to move forward only results in being pushed back into the same predicament. But beyond physical risks, child miners lose childhood itself. Children in these regions often do not have the luxury of school, play, or a carefree youth; instead, they enter a workforce that strips them of their innocence far too soon. With children starting work in the mica mines as early as five or four years old (Refinery29), they are thrown into a workforce that strips them of their innocence all too soon. This predicament is reminiscent of *Catch-22*, where Nately’s whore’s kid sister grows up in a brothel, conditioning her to that harsh environment and removing her of virtually all of her innocence. Instead of having healthy hobbies or a normal childhood, she tries to emulate her older sister, displaying behavior such as hurling “herself onto the bed jealously so that Nately could embrace her, too” (Heller). Both the kid sister and the child laborers in mica mines are thrust into a world too mature for their own good, shaped by the need to survive and remove their agency. In a world just as, if not more, absurd than that of Heller’s novel, child laborers are faced with a *Catch-22* of their own—they have no education because they must mine mica, but their only option is to mine mica because they have no education. Jharkhand has a literacy rate of only 66%, compared to a 73% national average, and only 2% of residents have completed secondary education, highlighting a severe

lack of agency—in several aspects, education is agency and allows you a degree of social mobility. In *Catch-22*, Yossarian is asked where he was born and answers, “On a battlefield.” When pressed further, he responds, “In a state of innocence.” This moment encapsulates the environment that child mica miners live in—their lives become defined by labor, caught in a system that offers them no escape.

To improve the ethicality of the mica supply chain, multiple solutions have arisen throughout the years, but are not without their limitations. Among them is the rise of synthetic, lab-grown mica, which would reduce the need for mica mining. According to the cosmetic brand Lush, synthetic mica, or Synthetic Fluorophlogopite, gives a similar shimmery gleam as natural mica. However, since synthetic mica is a man-made substance, it has a higher purity and smoother edges than natural mica, giving it an even brighter and finer sparkle in cosmetics. Additionally, synthetic mica stands as an environmentally friendly alternative to plastic glitters—despite its manmade status, Lush asserts that synthetic mica is still constructed with natural minerals. Even with these benefits, implementing synthetic mica as a replacement for natural mica has its fair share of challenges. In transitioning to synthetic mica use starting in 2014, Lush encountered several roadblocks, including a remaining surplus of natural mica that needed to be used up first. Alarmingly, in 2016, Lush discovered natural mica in a pigment range that was marketed as synthetic, highlighting the need for tighter controls and suppliers’ reluctance to fully commit to the use of synthetic mica. While synthetic mica has become increasingly popular in the cosmetic industry, other industries have been slower to catch on. In a report commissioned by Terre des Hommes Netherlands, almost all synthetic mica production occurs in the cosmetics industries and a small portion is used in paints (Schipper et al.). The demand for natural mica far outshadows that for synthetic mica, with natural mica accounting for 90% of the market share in 2015. Additionally, Schipper et al. report that synthetic mica comes at a hefty cost premium compared to natural mica, and because cosmetics and paints use a much lesser volume of mica than other goods and thus face a lower cost when using synthetic mica, only the cosmetics and paints industry have shown notable usage of synthetic mica. In contrast, other industries are much more reluctant to make the switch. However, with the increasing demand for electronics and electronic vehicles alongside technological advancements in creating synthetic mica, a report by Verified Market Research posits that the market awareness for synthetic mica will increase, projecting that from 2024 to 2031 its market will increase at a CAGR of 11.5%, far greater than Schipper et al.’s projection of 3.9% from 2016 to 2024. Another limitation of synthetic mica is that although the pay is nowhere near enough, entire villages rely on the income from mining natural mica. Thus, the Responsible Mica Initiative (RMI) seeks not to eliminate natural mica extraction, but aims to “establish responsible workplace standards, empower local communities and establish a legal framework for the mica sector” (Fair Wage Network and BASIC Reports). Many leaders in the paints, cosmetics, and automakers industries have joined the RMI, including PPG, AkzoNobel, L’Oréal, Shiseido, LVMH, Porsche, BMW, and Mercedes Benz (Fair Wage Network and BASIC Reports). Through BJSAM Community Empowerment Programs (CEPs) across 50 villages from 2021 to 2024, “71% [possess] tools necessary to enhance their livelihoods, while 36% noted diversification in their income sources. 44% of households experienced increased income from their primary means of livelihood, highlighting the program’s effectiveness in promoting financial stability” (Responsible Mica Initiative Community Empowerment Program Impact Assessment Report). The CEPs helped to maintain safe sources of drinking water, and established nutrition camps, and children’s education centers, tackling both the root causes of and the effects of illegal mica mining (Responsible Mica Initiative Community Empowerment Program Impact Assessment Report). In a similar vein, the Kailash Satyarthi Children’s Foundation, funded by government services and businesses like Estée Lauder, created a model coined the “child-friendly village,” which connects parents to different

income sources so their children don't need to work. As of 2019, they have helped withdraw more than 3,000 children from child labor and enroll in school (Refinery29). The "child-friendly villages" highlight the positive impact of companies choosing to stay connected with the companies they work with.

The mica industry remains riddled with worker rights abuses—hundreds of thousands of tonnes of mica are mined with the blood, sweat, and tears of underpaid and overworked laborers, including children; this serves as a poignant example of a broader "profits over people" philosophy that far too many companies embody. However, there is a glimmer of hope for progress being made to transform the mica industry for the better. The rise of synthetic mica and the Kailash Satyarthi Children's Foundation demonstrates that change is possible, even if progress is slow. However, without stronger legal enforcement, economic diversification, and importantly, consumer awareness, systemic poverty and lack of alternatives will keep miners trapped in their absurd cycle. No simple solution exists, and with the range of consumer goods in which mica is present, it may be impossible to avoid products made off the backs of exploited labor. Despite that, the first and most critical step towards improvement is acknowledging the reality behind the shimmer, forming a foundation where a future can be built so that workers—especially children—will not sacrifice their safety and future for companies that have profited from their suffering.

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"Treat These People Like Cattle": Challenges and Resistance to ICE in the 21st Century

Stephanie Liu

“The War Department replied touchily that there had been no error and that she was undoubtedly the victim of some sadistic and psychotic forger in her husband’s squadron.” In Joseph Heller’s *Catch-22*, Doc Daneeka is presumed dead despite countless eyewitnesses who were able to testify to his very alive presence and a handwritten letter signed by him addressed to his wife. The reason: it would be too difficult bureaucratically to alter the records to accurately reflect the fact that he was, in fact, alive. Thus, Doc Daneeka walked a living contradiction, emblematic of a bureaucratic issue of far greater magnitude. While Heller’s novel was largely satirical and a hallmark of absurdism, we are currently witnessing a similarly absurd system play out in front of us within the US Immigration and Customs Enforcement (ICE). Far too often, immigrants find themselves in the position of Doc Daneeka, victims of an unnecessarily contradictory and inhumane process. Beginning under the George W. Bush Administration, ICE assumed the responsibility of enforcing federal immigration and border policy; however, the law enforcement agency has garnered a notorious reputation for ripping families apart and its inhumane detention facilities. For instance, both the Secure Communities program started during the Bush Administration and further expanded under former President Barack Obama and President Donald Trump’s zero-tolerance policies have contributed to ICE’s identity as a vehicle for anti-immigration rhetoric and seemingly nonsensical commands, just as absurd as in *Catch-22* (Perez, *How US Policy*). Although there must be some form of immigration regulation and border control in the US, current executive enforcement through ICE is both unviable and inhumane; not only have immigrants and their families protested against the deplorable conditions of detainment camps and ICE’s contradictory deportation methods, local and state level agencies have also taken action in defiance of federal policies. Continuation of these practices will only result in further Constitutional and human rights missteps—ICE must be reformed.

The promises of the second Trump Administration foreshadow an even stricter government crackdown on undocumented immigration through ICE with increasingly dire conditions; it is evident that the federal government is fully prepared to authorize unseen levels of ICE oversight. Trump’s 2024 campaign rhetoric was far more inflammatory than it was in 2016—“build a wall” became “deportation to Guantánamo Bay” and “they’re stealing our jobs” became “end birthright citizenship.” He has mostly stayed true to his promises, announcing an executive order on January 29, 2025 that allowed for the deportation of “the worst criminal aliens” to an in-construction detention facility with a capacity of over 30,000 at Guantánamo Bay. According to White House border czar Tom Homan, ICE would be put in charge of the facility, specifically built for “people who are hard to deport” (Sullivan). However, a multitude of issues arise with this executive order, the most significant of which is that the proposed capacity of tens of thousands of criminals is simply unattainable. Although Homan claims that the existing migrant center would be expanded, it would need to grow over a degree of magnitude to accommodate the expected number of immigrants. Since many governments still refuse to accept immigrants deported from the US, experts speculate that the new Guantánamo Bay facility would be their primary destination. The current administration is undoubtedly the foremost proponent of ICE operations, having given the agency its full support and backing while simultaneously diminishing the power of other areas of government; complete oversight over the Guantánamo Bay facility is only one example. Additionally, the location itself inspires fear and associations with the War on Terror following 9/11. The present migrant facility—separate from the military prison—overseen by ICE has its own checkered history of human rights violations and deplorable conditions. The International Refugee Assistance Project released a report in late 2024 that outlined the extent of the conditions at the facility, noting that they were “characterized by undrinkable water, exposure to open sewage, and poor medical care and schooling facilities for children.” Yet Homan refuted these claims, declaring instead that “ICE has the highest detention standards in the industry. You can’t find another state, federal, or local facility that has

higher detention standards than ICE” (Collinson). Apart from the government, the fact that far too many ICE detention facilities contain inhumane conditions and occasionally even constitute human rights violations remains undisputed. Photographic evidence and individual testimony exist that corroborate the report’s findings, and the immense asylum backlog speaks for itself. Nevertheless, the federal government across many 21st-century administrations still firmly supports its initiatives through ICE. Given the orders passed in the first few weeks of this current administration and associated rhetoric, it is evident that ICE’s authority and purported legitimacy in its processes will only be further reaffirmed, perhaps even magnified, under President Trump.

Although there is no resistance to ICE within the federal government—only a euphony of support in the institution—the same cannot be said elsewhere. Immigrants themselves are taking agency in their own situations, many of whom are speaking up about their experiences and encounters with deportation or detainment through ICE. They highlight the occasional contradicting orders from ICE that only further confuse them, leading to deportations that need not have included force or custody. One such instance is the case of Amer Adi, a Lebanese immigrant who had lived in the US for over forty years and was served deportation papers by ICE in January 2018. Although devastated, Adi made the appropriate arrangements to be out of the US by the ordered date but was notified that the order was called off a mere week before his scheduled departure. This was later revealed to have been an instance of bureaucratic misinformation, as Adi was soon taken into custody because he did not leave by the original date even though it was ICE itself that informed Adi of the change. Adi’s attorney in the case stated, with regards to ICE, that “Now what we have is an agency that has been told ‘go rogue.’ ‘Treat these people like cattle.’ ‘They have no value’” (NowThis). Adi’s case is demonstrative of the miscommunication rampant within ICE—not only did ICE deprive Adi of leaving the US with dignity, but the agency also dehumanized him and other immigrants who experienced similar proceedings. He was forcefully taken into custody and confined to inhumane conditions at the whim of the government in a process rife with miscommunication. In response to activities like these, communities are mobilizing together against these unjust acts, especially in predominantly immigrant-reliant cities. During an interview with CNN, Homan admitted that “Chicago [is] very well educated. They’ve been educated on how to defy ICE, on how to hide from ICE.” Chicago is not the only city that has rallied around protecting those that constitute the foundation of certain communities, nor is it now the first time we have witnessed such cooperation against ICE. In the height of Obama’s deportation campaigns, volunteers monitored and reported ICE activity using encrypted messaging apps and text alerts; in Trump’s first administration, coordinated efforts amongst neighborhood groups resulted in “Know Your Rights” educational campaigns, much like what is occurring in the status quo (Draper). These communities understand that undocumented immigrants, though they did indeed arrive in the US by illegal means, form the backbone of entire industries and may have faced systemic challenges in their nations of origin that perhaps forced such measures. By entering private businesses with simply administrative warrants, not the necessary judicial warrants, ICE has violated federal law and will continue to do so until community members educate one another on their Constitutional rights. Communal effort on such a scale poses one of the greatest challenges to illegal ICE proceedings, indicative of the extent to which unrelated parties are willing to rally together against the agency.

Not only have immigrants and immigrant communities challenged the authority of ICE, but state and local-level governments have and will continue to resist the agency’s orders as well. The challenges posed by the Secure Communities program are perhaps most emblematic of inter-governmental resistance. The program involves the usage of inmates’ fingerprints gathered at jails to determine their immigration statuses, which then potentially initiates ICE detainer requests; it

sparked immense controversy due to the burden it placed on state and local level law enforcement to work in tandem with ICE. In 2011, before Secure Communities was ruled unconstitutional, Santa Clara County passed an ordinance that effectively ended its collaboration with ICE through this program. The ordinance requires that there must be a “written agreement with the federal government by which all costs incurred by the County in complying with the ICE detainer will be reimbursed” (Perez, Santa Clara County). Since ICE has not yet reimbursed any county that participated in Secure Communities over its three-year history, this measure forced ICE to either reimburse counties or face Santa Clara’s noncompliance. It is difficult to tell whether this ordinance originated from a desire to protect the rights of undocumented immigrants or from the mere bureaucratic and financial headache of the program. Regardless of the reason, it is evident that the institution of the government itself is effectively resisting its own operations. Furthermore, sanctuary cities have historically limited cooperation with federal immigrant agents such as ICE regarding the arrest and deportation of undocumented immigrants. These cities have clearly declared their motive, to protect the rights of undocumented immigrants—there is no confusion in this case. Sanctuary cities “generally do not comply with federal requests to detain undocumented immigrants who have been arrested on charges unrelated to their immigration status and turn them over to the federal authorities for possible deportation.” Following Trump’s 2017 repeal of the Deferred Action for Childhood Arrivals program (DACA), multiple local governments including the Sonoma County Board of Supervisors and the Atlanta City Council passed resolutions reaffirming their support of immigrants and calling for “limited cooperation with [ICE], to show that Atlanta opposes the decision to end DACA” (Blair). Such localities are emblematic of local-level resistance to increasingly overbearing federal policies targeting immigrants, representing a commitment not to the federal government, their supposed superiors, but rather to their constituents, regardless of nation of origin or immigration status. This is not a recent development either; sanctuary cities originated in the 1980s, suggesting that the roots of communal cooperation and unity far surpass any singular administration’s policies. Governmental resistance against the agency of ICE and its predecessors is not uncommon and continues to be vital in the fight for reform.

The root cause of the discontent surrounding ICE’s operations is predominantly due to the inhumane and contradictory system at play—in order for progress to occur on both sides, the agency’s most fundamental process must be reformed: deportation through detainment facilities. The fundamentals of the system are deeply flawed. ICE has failed to properly enforce the National Detention Standards (NDS), which outline the guidelines by which detainment facilities should theoretically operate, particularly in state or local jails operating under an intergovernmental service agreement (IGSA) under the pretense of wanting to avoid imposing additional burdens on such facilities. Under the NDS, immigrants should be offered initial medical screenings, yet “newly admitted detainees [often] never receive either the medical screening or physical examination that the NDS require.” They should also have access to legal materials for a minimum of five hours per week, yet “several facilities allow detainees far less time.” Furthermore, due to reasons such as staff shortages, “detainees are often in holding rooms longer than the maximum twelve hours permitted by the NDS” (Neeley). These inhumane conditions representative of far too many IGSA facilities associated with ICE are one of many reasons, in addition to the initial process of arrest, that immigrants and their communities challenge the authority of ICE. The NDS were not officially codified into law in the name of convenience but were fully intended to be treated as such, and the disregard ICE has for its requirements further demonstrates the need for reform in the way that ICE approaches immigrant detainment. A possible alternative to detainment facilities and the increasingly inhumane conditions within is the reinstatement of the Family Case Management Program (FCMP). Under this program, case managers are assigned to families and are responsible for ensuring that

immigrants meet their legal obligations such as check-ins with ICE and attendance at court hearings. In its two-year tenure, it was mostly a success, seeing a “99 percent compliance for check-ins and 100 percent compliance for court hearings” (La Corte). The FCMP also has a financial cost of almost a degree of magnitude less than that of detention for comparable individuals. However, the low cost of the FCMP would most likely be unsustainable if it were to be adapted into a nationwide system. This limitation can largely be attributed to the size of the asylum backlog. With our current immigration system, asylum decisions are not produced in a timely manner which would evidently increase the cost of FCMP over time. The rate of detainment far exceeds the capacity of either detainment facilities or the FCMP by itself; however, in conjunction with other programs, the latter could perhaps minimize the current difference and allow for a more humane process. Considering the totality of circumstances, even if the federal government spends an equivalent amount on both the current detainment facilities and the FCMP, the FCMP would yield a greater success rate in addition to its undisputedly superior conditions. Even so, this would still undoubtedly be limited simply due to the nature of the Trump Administration’s policies, but the reinstatement of the FCMP would alleviate a significant portion of the current problem.

The operations of the US Customs and Immigration Enforcement must be reformed to allow for a more transparent, uniform, and humane immigration system. Further research could examine the politics and interpersonal influence of the Trump Administration’s recent immigration policies, such as the prioritization of white South Africans for refugee resettlement. In light of the contradictory internal workings of ICE and the contradictory external workings of Trump’s immigration policies, it is evident that change must occur imminently. Nevertheless, for change to be enacted at all, we must, in the words of David Foster Wallace, deviate from our “natural default setting.” We must come to the realization that no individual is “the centre of the world” nor “should [they] determine the world’s priorities.” Regardless of one’s stance on immigration and whether or not undocumented immigrants should be deported, the current conditions of ICE detention facilities are without a doubt inhumane. We ought to depart from our natural default setting and attempt to perceive the situation from the perspective of the immigrants themselves; in doing so, we may come to understand that, despite our different political, economic, and social beliefs, we are all human irrespective of our immigration status and deserve some level of humane treatment. We must never blindly accept a system that treats these people like cattle.

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Co-occurrence of extreme heat and pollution in the Southwest United States

Arjun Maganti

Abstract

In this research paper we examine the co-occurrence of extreme heat and humidity in the Southwest United States between 2003 and 2023. Using simple statistical regression analysis, time series analysis, and spatial compositing, we demonstrate that humidity, when coinciding with extreme heat, tends to exacerbate air pollution. Specifically, we find that humidity and heat have the largest impact of PM_{d <2.5μm} and carbon monoxide (CO) with a lesser impact on other pollutants. We hypothesize the hygroscopic nature of PM_{2.5} particles and the reactive CO molecules with NO_x and VOC compounds lead to amplified reaction rates during extreme heat and humidity. Next, we examine the meteorological conditions associated with the co-occurrence of extreme heat and humidity in Los Angeles and Sacramento. We demonstrate that heat waves in Los Angeles are associated with strong northwesterly winds, originating in the Mojave Desert, that are associated with anomalous warm atmospheric heat transport. This is also associated with decreased on-shore winds from the Pacific Ocean, which typically have a cooling effect. Decreased onshore winds resultantly lead to an exacerbation of heat conditions. These findings can contribute to further prevention of possible wildfire events caused by extreme heat conditions, and also lead to further protections against cases of extreme pollution in the southwestern United States.

Keywords

co-occurrence of extreme heat and pollution, climate change, South-west United States, compound events, air pollution

1 Introduction and Related Work

The southwestern United States is known for an abundance of wildfires ranging from man-made camping accidents to large scale forest fires. Despite decades of research, there is still much to improve in our understanding and preparation for wildfires. One particular area of research that requires further exploration is the co-occurrence of extreme events. For example, many fires, such as the Dixie and August Complex fires, co-occur during significant heat waves. Recent scientific study has shown that the frequency of co-occurring extreme heat, wildfires, and air pollution will increase due to anthropogenic global warming [1] [2] [3]. Here, we focus on examining the impact of co-occurring extreme temperature and humidity on air pollution.

There are several decades worth of literature examining the physical drivers and impacts of heat waves. Extreme heat can have profound negative impacts on human society, including affecting economic productivity, human mortality, and agricultural yield. These have shown that the frequency and intensity of extreme heat will increase due to global warming from the anthropogenic emission of greenhouse gases. Such studies have been conducted documenting all continents and parts of the

globe, confirming that these effects have global consequences [4] [5]. These studies provide valuable insight into the long term effects that heat waves have on the environments of places rather than just the effects they have on humans.

Similar to extreme heat, air pollution has been shown to be exacerbated by anthropogenic emissions of greenhouse gases and other pollutants. A study by Schnell et al. 2017 [5] analyzed co-occurrences of extreme temperature, surface ozone, and particulate matter over the eastern United States. The study concluded that temperature was a key factor to the increased levels of ozone and PM_{2.5} in the atmosphere. Pollution levels have also increased in countries such as the United States, Portugal, and the United Kingdom [3] [6]. Pollution is a human health risk and can impact respiratory and cardiac-associated mortality. As a result, examining the co-occurrence of extreme heat and pollution can have implications in health research as well [7].

As such, our research looks to further this goal by analyzing the impact of humidity on the co-occurrence of extreme heat and air pollution in the southwest United States. By analyzing the effect of heat and humidity on the anomalous occurrence of pollutants, we use a composite map analysis to understand the difference in pollutant occurrence over the western United States during humid and dry heat waves. We also use a time series analysis to perform a case-study of several historical extreme heat events. The aim of this study is to improve our understanding of how pollution differs between dry heat waves and humid heat waves in the Southern western United States.

2 Methodology

2.1 Dataset

This study uses the CAMS (Copernicus Atmosphere Monitoring Service) global reanalysis dataset, which provides comprehensive information about atmospheric composition, including temperature, humidity, and pollutants. CAMS is widely recognized in the field of atmospheric science for its high-resolution global data and assimilation of satellite observations. It was selected for its reliability, accessibility, and relevance to studying heatwave and pollution interactions.

We downloaded data from the CAMS global reanalysis dataset, covering January 1, 2003, through December 31, 2023. The spatial domain spans latitudes 32°N to 42°N and longitudes 114°W to 124°W, with each grid point spaced 0.7 degrees apart in both latitude and longitude. For each grid point and time step, the following variables were collected:

- Vector wind speeds (u10 and v10).
- 2-meter temperature (t2m).
- Mean sea level pressure (msl).
- Concentrations of particulate matter with diameter <2.5 m (pm_{2p5}).
- Total column concentrations of carbon monoxide (tcco), methane (tc_ch₄), nitrogen dioxide (tcno₂), and ozone (gtco₃).
- Total column water vapor (tcwv).

This produced a 3-dimensional dataset, structured with x and y coordinates for spatial positions, variable values for each of the chosen parameters, and a z-axis representing dates from 2003 to 2023. All variables were numerical, allowing for comprehensive statistical and graphical analyses.

The NetCDF (nc) dataset was converted into a pandas DataFrame for efficient manipulation and visualization.

Table 1: List of CAMS variables and their abbreviations used in the study.

Name	Abbreviation
10-meter U wind component	u10
10-meter V wind component	v10
2 meter temperature	t2m
Mean sea level pressure	msl
Particulate matter $d \leq 2.5$ m	pm2p5
Total column carbon monoxide	tcco
Total column methane	tc_ch4
Total column Nitrogen Dioxide	tcno2
GEMS Total Column Ozone	gtco3
Total column vertically-integrated water vapor	tcwv

2.2 Preprocessing

Firstly, the preprocessing stage involved narrowing down the dataset to focus on relevant parameters, specifically anomalies in temperature and humidity during the months of May through September. The goal was to identify patterns in heatwaves and humidity, particularly during summer months leading into wildfire season. We use the 95th percentile of 2-meter temperature values during the months of May, June, July, August, and September to extract heat waves from our data set. The purpose of this specifically is to extract the warmest days possible across the time period, and to specifically extract summer days leading into wildfire season as these days have the most relevance to overall pollution values. Similarly, we use the 90th percentile of water vapor during these same months to find the set of most humid days during this timespan. This process creates two datasets consisting of the 95th percentile of 2-meter temperature values for a location, and the 90th percentile of total column water vapor values for that same location. Intersecting the two sets gives us one combined dataset of the most hot and humid days for a specific x and y grid point.

2.3 Methods

Most formal research done in this topic uses a combination of mathematical models or neural network models to effectively predict such cooccurrences. These studies are out of the scope for this paper. Due to this, our paper will use a combination of two methods: time series analysis and composite map analysis.

Time series analysis is used to investigate the temporal relationship between heat waves, humid events, and pollutant levels. For this, anomalies in temperature and humidity were extracted for specific heat wave and humid wave events within a 10-day frame. Temperature or humidity served as causation variables, which were plotted on individual axes. Concurrently, pollutant levels, such as

particulate matter (PM_{2.5}) or total column ozone, were plotted on a dual y-axis within the same graph. This dual y-axis approach creates overlapping line charts, where one line represents temperature or humidity, and the other line represents the pollutant of interest. This visualization effectively highlights the temporal correlation and potential lead-lag relationships between these variables. Such analysis provides a detailed understanding of how individual heatwave or humid wave events impact pollutant levels in the atmosphere across the selected geographic region.

Composite map analysis was performed using the Cartopy library in Python to explore the spatial dynamics of atmospheric variables during heatwave and humid wave events. By mapping wind vectors, pressure gradients, and gradients of other atmospheric variables, we generated averaged maps that provide a comprehensive snapshot of the meteorological and atmospheric conditions during these events. Additionally, difference maps were created to isolate the effects of humidity during heatwaves. By calculating the differences in atmospheric conditions between hot days and humid-hot days, we were able to further investigate the influence of humidity on pollutant levels, such as ozone and particulate matter, during extreme weather events. These spatial analyses allow us to examine not only the localized effects of heatwaves and humidity but also broader patterns that may emerge across the study region.

3 Results

3.1 Composite Map Analysis

The composite map analyses are presented in Figures 1–12. Figures 1–6 focus on Los Angeles, while Figures 7–12 highlight Sacramento. Each figure consists of three panels:

The left panel represents the variable's average anomaly during hot days (95th percentile of t_{2m}).

The middle panel shows the anomaly during hot and humid days (95th percentile of t_{2m} and 90th percentile of tcwv).

The right panel illustrates the difference between the hot and humid day anomalies and the hot day anomalies.

Figures 1–6 display the behavior of six atmospheric variables in Los Angeles during anomalous events: 2-meter temperature (t_{2m}), particulate matter (PM_{2.5}), carbon monoxide (tcco), methane (tc_ch₄), nitrogen dioxide (tcno₂), and ozone (gtco₃).

Los Angeles, California (34.05 N, 118.25 W)

Figure 1: 2-meter temperature

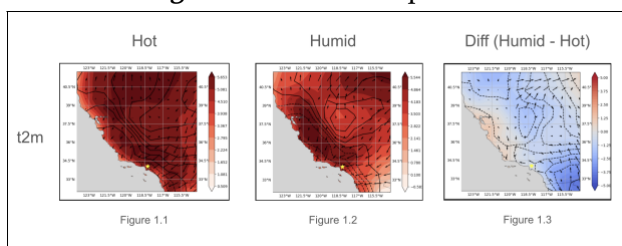


Figure 2: Particulate Matter $d < 2.5\mu\text{m}$

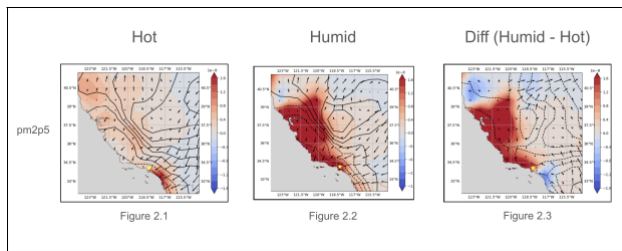


Figure 3: Total Column Carbon Monoxide

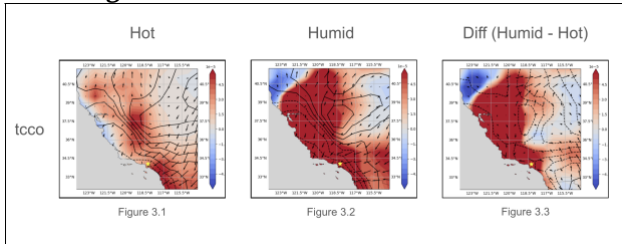


Figure 4: Total Column Methane

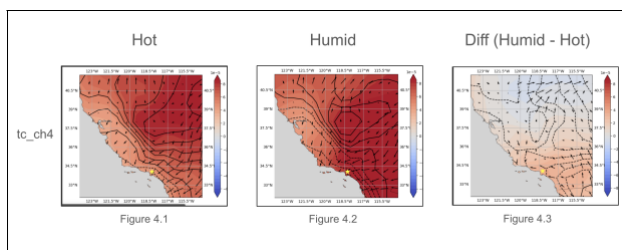


Figure 5: Total Column Nitrogen Dioxide

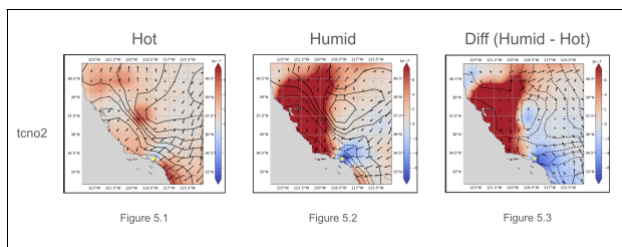
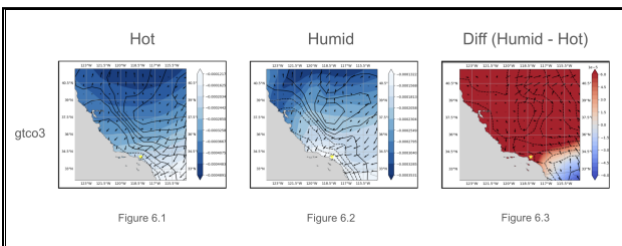


Figure 6: Total Column Ozone



In Los Angeles, composite map analyses reveal notable patterns for the six atmospheric variables during anomalous events. The 2-meter temperature (t2m, Figure 1) shows minimal differences between hot and hot-humid days, as the anomalies are inherently tied to the hot-day criteria, with slightly lower values on humid days due to stricter filtering. Particulate matter (PM2.5, Figure 2) exhibits significant positive anomalies on humid days, with wide-spread increases across the western portion of the state and the Central Valley, compared to the more localized anomalies near Orange County and San Diego on hot days. Carbon monoxide (Figure 3) displays substantially higher anomalies on humid days, with positive differences observed across the region except for inland desert areas, which remain largely unaffected. Methane (Figure 4) anomalies are generally small but consistently positive, with hot days contributing to markedly elevated levels compared to average conditions. Nitrogen dioxide (Figure 5) presents a more complex trend: hot days show negative anomalies near Los Angeles, whereas humid days result in significant positive anomalies extending north through the San Francisco Bay Area and Central Valley, as captured in the difference map. Lastly, ozone (Figure 6) is the only variable negatively correlated with heat, with hot days resulting in reduced ozone levels. However, humid days mitigate this reduction, leading to less pronounced negative anomalies and slightly higher ozone levels than on hot days alone.

Sacramento, California (38.58 N, 121.50 W)

Figure 7: 2-meter temperature

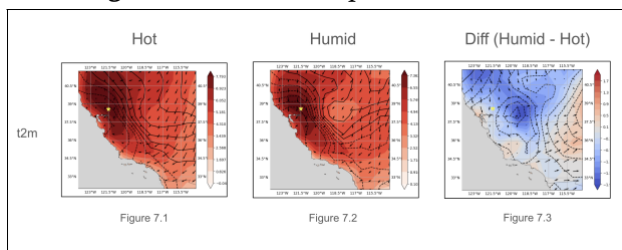


Figure 8: Particulate Matter $d < 2.5\mu\text{m}$

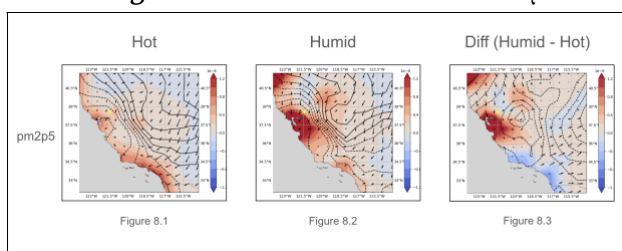


Figure 9: Total Column Carbon Monoxide

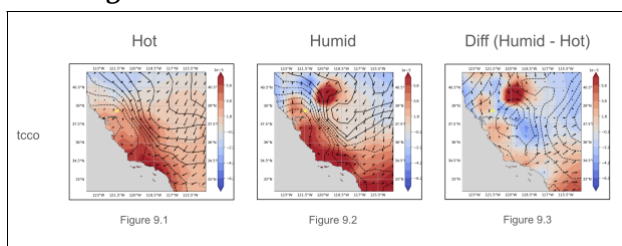


Figure 10: Total Column Methane

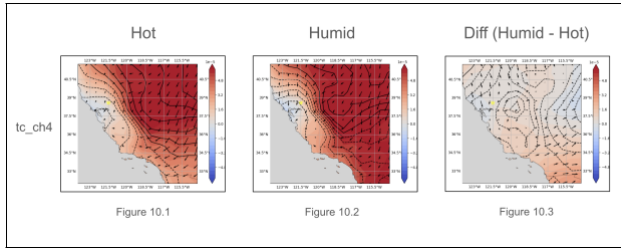


Figure 11: Total Column Nitrogen Dioxide

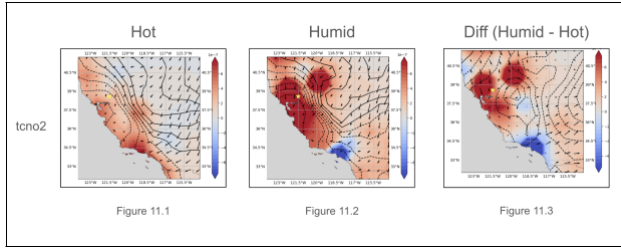
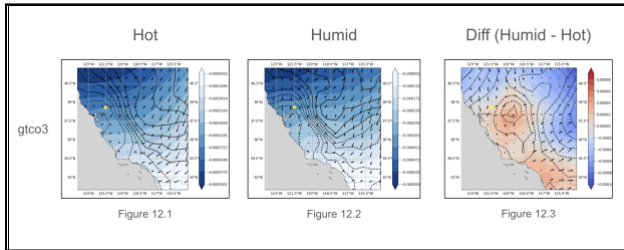
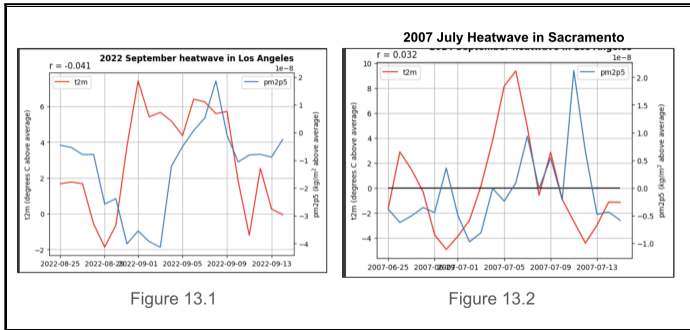


Figure 12: Total Column Ozone



In Sacramento, the trends in composite map analyses largely align with those observed in Los Angeles, with some regional distinctions due to its inland location. Temperature anomalies (t2m, Figure 7) show negligible differences between hot and hot-humid days. Particulate matter (PM2.5, Figure 8) demonstrates a similar trend to Los Angeles, with significantly higher anomalies on humid days, particularly across the Central Valley and surrounding regions. Carbon monoxide (Figure 9) anomalies in Sacramento are smaller on humid days compared to Los Angeles at the center of axis, reflecting its inland position, but still show positive differences, indicating the influence of humidity. Methane (Figure 10) follows the same pattern as in Los Angeles, with modest positive differences and elevated anomalies on hot days. Nitrogen dioxide (Figure 11) anomalies differ slightly, as coastal areas show negative differences, while inland areas, including Sacramento and regions to the north and east, exhibit positive differences on humid days, compared to Los Angeles which still exhibits negative anomalies. Ozone (Figure 12) trends are consistent with Los Angeles, with lower anomalies on hot days and less pronounced negative anomalies on humid days, suggesting a similar mitigating effect of humidity on ozone reductions caused by heat.

3.2 Time Series Analysis



To further investigate the lead-lag relationship between temperature and pollutants, specific examples provide valuable insights. Figures 13.1 and 13.2 illustrate two notable heat waves: the September 2022 heatwave in Los Angeles and the July 2007 heatwave in Sacramento. Both events exhibit significant temperature anomalies, with peak temperature variations ranging from 7 to 9°C (approximately 14 to 16°F) above typical values. A clear correlation is observed with particulate matter (PM2.5), as PM2.5 concentrations surge approximately 2 to 3 days following the peak of the heatwaves. These instances are representative of common heatwave patterns, and by aggregating multiple cases, we identify a general trend linking temperature anomalies to pollutant fluctuations. Although natural variation in PM2.5 and other pollutants exists, these examples demonstrate that substantial heat anomalies play a significant role in shaping pollutant levels, thus providing a clearer understanding of their dynamic relationship.

4 Discussion

Humidity's variability has significant impacts on multiple pollutants as discussed in the Los Angeles and Sacramento examples. The factors influencing specific variables' variations result from unique, but linked chemical processes that occur in the atmosphere. As such, each variable must be studied individually to examine the nature of our results.

4.1 PM2.5

In the instance of PM2.5, the size is the key factor why it is significantly higher on humid days. Hygroscopy is a process where a particle readily bonds with other particles around it without assistance of added pressure, heat, or circulation. PM2.5 particles are naturally very hygroscopic, and bond with the increased water vapor in the atmosphere, thus leading to larger PM2.5 molecules. These are detected as higher values by monitoring equipment [7]. Similarly, aerosols, small bundles of solids and liquids suspended in the air, tend to increase during humid events. Thus, previously non PM2.5 matter can be converted into matter that is detected and classified as PM2.5, thus increasing its detections.

4.2 Carbon Monoxide

Carbon monoxide also showed a significant increase on humid days. The main attributing factor is the way this variable was measured. The full name of the variable is total column carbon monoxide, which refers to the total amount of carbon monoxide present in a specific vertical shaft of the atmosphere from the ground to the top of the atmosphere. As a result, mixing within a column is not a viable explanation, although humidity does often lead to thermal inversions that would allow for restrained column mixing. Instead, a viable explanation could be the low rates of oxidation. CO typically reacts with hydroxyl radicals (OH) in the

atmosphere which allows its concentration to disperse over time. Water vapor, however, is a reacting agent that can exacerbate this process, resulting in larger CO values. Similarly, CO is a common byproduct of many other pollutants' reactions, like Volatile Organic Compounds (VOCs) and Nitric Oxide compounds (NO_x) [8] [9].

4.3 Methane

Methane has much smaller, but still positive anomalies on humid days than hot days. Similar to CO, the measurement of methane is throughout the total atmospheric column, eliminating mixing and the elevation of a measurement from a factor. Consequently, the lack of dispersion of methane is attributed to a variety of factors. Heat waves are generally associated with high pressure systems, and moist air can trap methane in stagnant air masses, causing its measurements to increase on humid days. As well as this, similar NO_x and VOC reactions can cause methane not to react with hydroxyl groups as much as they would on a hot, dry day due to the introduction of water vapor [10]. In a similar case to carbon monoxide, methane would increase, but not at the same rate due to its reactions tending to be slightly less frequent. A more biological explanation is also plausible. Humidity can sometimes lead to increased moss, fungi, and plants grown in soil, contributing to the flow of groundwater and reservoirs. This water can lead to methane-producing bacteria that also contribute, although on a smaller scale, to methane in the atmosphere.

4.4 Nitrogen Dioxide

Nitrogen dioxide (NO₂) shows a negative correlation with humidity in the center of axis for Los Angeles, but not for Sacramento. The negative correlation is due to the transformation of NO₂ into a different compound, nitric acid (HNO₃). In the atmosphere, NO₂ reacts with hydroxyl (OH) molecules to form nitric acid, and elevated humidity levels act as a key catalyst in this reaction. As a result, this essentially drains most NO₂ from the atmosphere. Nitrogen dioxide is also part of the NO_x family of gases, and this reduction in gases can also lead to the exacerbating effects of carbon monoxide and methane in the atmosphere. In contrast, the positive anomalies observed in Sacramento can be attributed to the influence of local atmospheric conditions, such as lower humidity levels and the proximity of the region to agricultural areas, which can contribute to increased NO₂ emissions.

4.5 Ozone

Although ozone has a large difference between humid heat and dry heat, all composited anomalies are negative. Ozone negatively correlates with heat. Ozone is typically associated with nitrogen dioxide, which means that NO₂ and O₃ reactions are used to regenerate NO and oxygen gas, leading to the reduction of both gases. This is known as the NO₂-O₃ equilibrium shift [9]. Despite this, the increase in ozone is evident. A plausible explanation for this circumstance is that increased water vapor plays a role in this reaction. Water vapor can cause the formation of peroxy radicals (RO₂) along with typical oxygen gas. As a result, atomic oxygen can combine with the oxides in these radicals to reform O₃, thereby regenerating it at the expense of nitrogen dioxide, which is not regenerated at the same rate.

5 Conclusion and Limitations

5.1 Summary

In this paper we examined the co-occurrence of extreme heat and humidity in the Southwest United States between 2003-01-01 and 2023-12-31. We use a combination of simple statistical regression analysis, time series

analysis, and spatial compositing to demonstrate that humidity, when coinciding with extreme heat, tends to exacerbate air pollution. Specifically, we find that humidity and heat have the largest impact of PM_d <2.5 μ m and carbon monoxide (CO), with a lesser, but still significant impact on ozone (O₃), nitrogen dioxide (NO₂), and methane (CH₄). We hypothesize that humidity has a larger impact of CO and PM_{2.5} because the hygroscopic nature of PM_{2.5} particles and the reactive CO molecules with NO_x and VOC compounds lead to exacerbated results especially in extreme heat and humidity. Additionally, we examine the meteorological conditions associated with the co-occurrence of extreme heat and humidity in Los Angeles and Sacramento. We demonstrate that heat waves in Los Angeles are associated with strong north-westerly winds, originating in the Mojave Desert, and anomalous warm atmospheric heat transport due to large pressure gradients between said areas. This is also associated with decreased on-shore winds from the Pacific Ocean, which typically have a cooling effect, but are non-present in these situations due to the reversal of the winds. Similar studies have been conducted for other regions of the globe [11], however, to the best of our knowledge, this is the first study systematically examining the co-occurrence of extreme heat, humidity, and pollution in the Southwestern United States.

5.2 Limitations

There are several limitations to this study and avenues for additional analysis. First, we do not examine the robustness of our heatwave definition. We define heatwaves using a 1-day exceedance of the historical 95th percentile of 2-meter temperature. While this quantile-based measurement of heatwaves is standard in past studies, most studies require that this occurs for 3 or more consecutive days. The definition used here simplifies the complexity of heatwaves and overlooks multi-day thresholds that are more robust. If given additional time, we would explore the robustness of our results using various heatwave definitions from other studies. Second, we would like to more thoroughly examine the meteorological conditions associated with the co-occurrence of extreme heat, humidity, and pollution. For example, we may investigate the impact of regions with climatological inversions (e.g., the Central Valley of California and Los Angeles) and compare rural versus urban centers. Finally, we do not control for the impact of wildfires, which may influence the results of this study. Wildfires can both trigger heatwaves and be exacerbated by them, and while humidity can play a role, it is unlikely to be the only contributing factor. The significance of humidity relative to other factors cannot be fully determined in this study. Further research should isolate the independent effects of various factors, including wildfires, to increase the robustness and accuracy of studies on this topic.

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From Rags to Riches: The Portuguese Dominion of the Transatlantic Slave Trade, 1500-1600

Jason Nishio

The Transatlantic slave trade was one of the most inhumane yet profitable systems in the history of colonialism. This began in the 15th century, when the Portuguese first arrived in West Africa, namely Porto Santo in 1418 and the Gold Coast in modern-day Ghana in 1471. According to Bethencourt and Diogo Ramada Curto, the initial goals of the Portuguese in colonizing West Africa are debated; however, the Portuguese were mostly interested in gold production and finding a trade route to Asia. Although they monopolized slave labor, it was far more profitable than gold or agriculture. Thus, the Portuguese success in the monopolization of the labor market ultimately introduced enslaved people as commodities to the global economy—because of slave labor’s economic efficiency for plantations and its high demand, it became a highly valued commodity, which led to the mass exportation, transportation, and exploitation of African people by the Portuguese. The Portuguese succeeded by employing a number of strategies and left a lasting impact on the global economy.

The Portuguese success in dominance of the slave market was greatly influenced by the improvised economic strategies that were employed. One of the most notable strategies that were used includes the Portuguese’s mostly peaceful relationship with local African leaders. They avoided “direct combat and established commercial relations with West and Central African leaders, who agreed to sell slaves taken from various African wars or domestic trading.” (Battle) However, the peaceful relations did not last since the demand for slaves rose with an insufficient supply: “They formed military alliances with certain African groups against their enemies. This encouraged more extensive warfare to produce captives for trading.” The Portuguese made peaceful relations with African leaders, to a limited extent. When the demand for labor increased to the point where the Portuguese’s supply could not satisfy it, the Portuguese started turning to violence; however, this violence was more proxy than direct, as a way to exploit conflicts between the different African leaderships and acquire slaves at a low cost.

Bethencourt and Diogo Ramada Curto also note how the Portuguese first attempted to acquire their slaves by seizing African villages and capturing people, which they quickly realized was ineffective due to African resistance. Instead, “the Portuguese negotiated with African rulers... offering commodities such as brass, textiles, shells, and luxury items and sometimes military assistance in return for trade concessions and access to the pool of potential laborers.” The Portuguese made alliances with African leaders, offering western luxuries to the African rulers, further incentivizing slave trade and conflict amongst African groups mentioned before. In this manner, the Portuguese crafted improvised strategies to ensure a steady supply of slaves, allowing for exponentially growing success.

The Portuguese were largely successful in achieving their initial goals of economic gain, although it was not from the means they first intended to achieve. In fact, their preliminary attempts in Morocco, according to Birmingham, saw little success with its primarily agricultural economy before the introduction of the slave trade, due to its dire conditions and thus lack of Portuguese people voluntarily emigrating to labor in Morocco. The Portuguese’s economic success came once they discovered the profitability of the slave trade, as “kidnapping was a more lucrative employment than farming.” (Birmingham) Thus, according to the Mary Battle, the Portuguese were the first European nation to make slave trade a highly profitable global commodity. Because of the aforementioned growing demand for labor in plantation economies such as in the Americas, the value of slaves, which allowed for efficiency of cost for labor when producing cash crops, skyrocketed, allowing for the Portuguese’s profitability and success in the slave trade. Although the Portuguese gained a large sum of profit from the slave trade, it is important to understand the extent of its success and its sustainability. Christopher Ebert argues the Portuguese dominion of the market was unsustainable because of its weak security and enforcement, allowing other European countries to compete. He mentions how the Portuguese taxed non-Portuguese countries, requiring “special licenses” to trade in their territory, and “used violence to disrupt African trade that did not flow through its authorized agents.” However, because of its

weak enforcement and limited resources, Ebert argues that the Portuguese were unable to sustain its dominance of the slave trade.

As a result of the Portuguese presence in West Africa and its involvement in the slave market, the African population and the global economy were heavily impacted. This is mostly seen in how Africans were exploited and rapidly transported in massive amounts. According to da Silva's data table (Appendix A), 27,888 slaves embarked on Portuguese-Brazilian ships from 1575 to 1600. The number of slaves being exported from West Africa was exponentially growing in the 1500s, starting off with just 4,666 total slaves embarked from 1514 to 1575. The enormously high upward trend in the slave exportation beginning at the 1500s, which will reach over 1 million in the 1800s, shows the heavy impact on the West African populations due to the Portuguese slave trade; thus, the Portuguese succeeded in influencing and manipulating the flow of the West African economy in the 16th century. This is also seen in the specific ways the West African populations were changed because of the Portuguese: "African slaves provided much of the labour for the cotton and dye-processing. The agricultural and trading activities of the Cape Verde islands were made possible by the transportation of Africans from the neighbouring mainland to provide slave labour. In 1582, the combined population was 1608 whites, 400 freed slaves and 13,000 slaves." (Ijoma) In Cape Verde, as well as plantation colonies in São Tomé and Príncipe, the Portuguese primarily used African slave labor for production, such as cotton and dye processing, which was largely supplied by Africans from neighboring regions. The Portuguese manipulated the economy by controlling the crops the slaves made and facilitating an enormous forced migration of the natives. The disproportional demographics further show the populational impact on West African regions by the Portuguese. Although Fage and McCaskie argue that the Portuguese were the most successful in monopolizing the economy in the West African coast among all the European nations from 1450 to 1500, they also question the extent of the impact of the Portuguese presence in West Africa. They argue that the Portuguese achieved their economic goals in the 16th century; however, they were the only Europeans that were "consistently involved" in West Africa prior to 1600, and the Portuguese were weak outside the Gold Coast and only controlled "some aspects of trade," thus having a limited impact on the history of West Africa. They also say that "the main changes were that a few Africans" were "acquainted" with Christianity and the Portuguese language, and the introduction of new crops. Ultimately, although they argue that the Portuguese were not as impactful in the course of West African history, the Portuguese's activities in the 16th century marked the beginning of a global economy along with economic and cultural influences on West Africans.

In the 16th century, the Portuguese implemented several economic strategies, leading to their successful monopolization and a lasting economic impact on the world. The Portuguese monopolization of the West African slave trade is similar to modern-day corporations in that modern-day corporations rely on foreign-sourced cheap labor in production and manufacturing. For example, many companies manufacture goods in countries such as China or Vietnam, where the minimum wage is lower than domestic minimum wage, allowing companies to produce goods with cheaper prices and thus make a larger profit. Just as modern-day corporations use foreign-sourced cheap labor, empires such as Spain used cheap or free labor taken primarily from West Africa. Vladamir Lenin argues that imperialism is the fruit of capitalism; it guarantees capitalist success. He says that in conquering the territory that holds all of the resources for a product, a country can politically guarantee a corporation's monopoly in a good, and thus imperialism is the "highest stage" of capitalism. This is what the Portuguese did in West Africa, but with no corporate involvement. However, Lenin warns that the more capitalism is developed, the greater the competition and struggle between other countries. This is exactly seen in the case of the Portuguese dominion in the slave trade; although the Portuguese's economic strategies were effective while they lasted, the Portuguese were unable to sustain their monopoly past the 19th century, due to not only British abolition but also rising competition in Africa between other European nations. So, corporations should be prepared for competition to avoid declination similar to that of the Portuguese.

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Strait Business: The Neo-Colonial Exploitation of Taiwan

Jason Nishio

Let's get this straight—Taiwan is an actively developing country. But hold on, let's take a step back—is it really even a country? This is something that historians and people, especially of Chinese ethnic descent, have been debating over for decades. Following its long history of colonization with centuries of Chinese rule during the Qing dynasty from 1683-1895 and Japanese rule from 1895-1945, Taiwan has always been considered a gray area in terms of its sovereign identity. After the Chinese Civil War following World War II, control of Taiwan was taken by the Republic of China (ROC) led by the Kuomintang. Ever since, Taiwan has been in a state of ambiguity where intense debate is had on whether or not Taiwan is a part of China. Because of its self-governance in a democratic system, Taiwan inevitably aligned with America during the Cold War period, which undoubtedly isolated it from China for decades. This led to a large amount of "neo-colonial" influence in Taiwan that controls it in modern ways without direct colonization—by "developed" nations like America—since the Chinese Civil War in Taiwan's post-colonial period. Due to globalization and contemporary economic affairs between Taiwan and larger, established powers like China and the United States, Taiwan has faced and is facing economic marginalization and that makes it inherently under neo-colonial rule.

Before understanding the ways Taiwan is exploited through neo-colonialism, it is important to understand the upbringing of the modern Taiwanese economy. "Taiwan's economic activities with the mainland Chinese economy have grown dramatically since Taipei began lowering its barriers to cross-strait ties in the mid-1980s, and mainland China has been Taiwan's premier external economic partner for several years now. Taiwan's cross-strait trade and investment now account for a very large percentage of all its externally oriented economic activity" (Tanner). Taiwan's economy has become heavily economically reliant on China in the last 40 years, following several decades of separation with China and alignment with the United States during the 1950s to 70s. This has made Taiwan vulnerable because of China's ability to easily inflict detrimental economic damage to it—consequently, China can and has disrupted Taiwan's stock markets. "In late 2001, China displaced the United States as Taiwan's largest export market, and by 2003 China had emerged as Taiwan's largest overall trading partner" (Tanner). Murray Scot Tanner mentions how the cross-strait trade between Taiwan and China exponentially grew from the dawn of the 21st century, which is reflective of the relative competition there is between China and the US in milking Taiwan's global technology industries—specifically in semiconductors. It is also reflective of Taiwan's unfortunate political and economic global position; as a developing country and a shadow of China scarcely formally recognized as a sovereign nation, its talents are disallowed from blooming as a result of the voracious developed and established worlds. Though Taiwan is indubitably a salient example of modern exploitation from global power dynamics, Glaser notes that "in 2019, Taiwan was the United States' tenth-largest trading partner, with total trade valued at \$85.5 billion dollars, putting it ahead of countries such as Italy, Vietnam, and Brazil," spotlighting Taiwan's global prominence in trade that makes it a unique target for neo-colonialism. Standing in stark contrast to its small geographic size, Taiwan's position in the global economy makes larger nations like the US depend on Taiwan, allowing Taiwan to have some resistance to neo-colonial rule. However, as we will discuss in this paper, powerful nations will find their way of pressuring Taiwan and benefitting from Taiwan's success.

The China-Taiwan "cross-strait" economic relationship may seem one-sided favoring China, but in reality it is quite complex. Despite Taiwan's aforementioned small geographic size, Taiwan's role in the global economy makes it much more difficult for China than to simply invade and execute what is called reunification. Tanner

notes that Taiwan has a large foreign exchange reserve, with its “highly attractive package of high-tech companies that should be able to find new markets and production venues outside the mainland.” The largest modern technology manufacturing companies including Apple, Nvidia, Google, and Qualcomm utilize the Taiwan Semiconductor Manufacturing Company (TSMC)’s processing technologies. So, while Taiwan’s semiconductor and technology industry serves as a crucial pillar to the Taiwanese economy, it also serves as one for multinational companies, as Taiwan alone produces the majority of the world’s most advanced semiconductors. Because of Taiwan’s keystone role in the global tech economy, Taiwan holds a degree of power and jurisdiction when dealing with globalization and neo-colonialism—much like the phenomenon observed in OPEC, another group with origins from post-colonization that faces exploitation for its lucrative industry, though Taiwan has not done anything as bold as OPEC’s shutting down of oil supply in its 1973 embargo. Although Taiwan holds some resistance and is not completely one-sidedly controlled by China and other large foreign countries due to its essential semiconductor supply, the fact still remains that the Taiwanese economy is heavily dependent on trade, as its GDP’s majority is made up of exports of services and goods. In chapter 13 of his book *Taiwan and China: Fitful Embrace*, Dr. Jing Huang argues that Taiwan faces a dilemma in which it must choose between deepening its economic interdependence with China or becoming marginalized by international affairs. He makes clear the tension that Taiwan faces as it is put in between the US and China. As Xi Jinping’s policy tries to prevent Taiwan from reaching *de jure* independence—with ideas including the “One-China principle” and the idea of reunification—Taiwan is pressured to choose a side to depend on. Taiwan is bound by a(n) (inter)dependence with China; while its international status is declining, it is more difficult for Taiwan to shift away from depending on China. Dr. Huang also mentions that there is a mismatch between the views of the Taiwanese people on their national identity and the riptide that pushes Taiwan towards heavily relying on China economically, away from its desirable position: “Although Taiwanese people seem to be less and less identifying with mainland China nationally and politically, Taiwan has been deeply drawn into China’s economic orbit, while its international status, in terms of both legitimacy and influence, continues to decline.” The Taiwanese people want to be viewed as separate from the Chinese, yet due to the country’s geopolitical and economic status, it is forced to be a pawn of the motherland. Jing depicts the complexity of the situation and the difficulty in finding a solution for Taiwan. Because Taiwan inevitably depends on the export economy, it is difficult to find a simple solution to making Taiwan entirely economically independent and free from foreign control. Singleton et al. investigate the ways China may prevent Taiwan from reaching economic independence from the mainland. In their 2024 memo, they say that China may brute-force its way to making Taiwan submit—the CCP will likely employ cyber-enabled economic coercion to force Taiwan into submission, to realize its goal of reunification. They analyze possible “worse-case scenarios,” along with Taiwan’s vulnerability, and how Taiwan can be destabilized easily by China. They discuss tabletop exercises (TTXs) that study this—in one of them, “the CCP simultaneously continued economic attacks on critical infrastructure, disrupted supply chains, reduced confidence in Taiwanese manufacturing, and unleashed cyberattacks and disinformation campaigns that undermined communications, energy, and banking systems.” This was concluded to quite possibly make Taiwan extremely unstable and isolated from the global economy, which could take a detrimental toll to its GDP and wealth. Because of Taiwan’s heavy dependence to China and China’s political and economic pressure, China can easily manipulate Taiwan’s economy, making Taiwan fundamentally neo-colonially ruled by China.

The People’s Republic of China is not the only global entity that is responsible for neo-colonial influence on Taiwan—the United States also plays a crucial role in serving as an exploiter of the Taiwanese industrial success. The US’s relationship with Taiwan may be more complex than that between Taiwan and China—although the US seems like it is an altruistic protector of Taiwan from Chinese invasion, which it arguably might be, the US uses its power over Taiwan and its global position to exclusively benefit itself from the Taiwanese technology industry. An article by the Global Taiwan Institute illustrates how the US does this with export controls and industrial policy, giving itself more leverage over Taiwanese companies, above China. By lowering the “*de minimis* thresholds for the FDPR” (Foreign Direct Product Rule), where the US made it so that “direct products” of the US include products made by foreign companies that use US technology instead of just products made by US companies, the US gained more jurisdiction over international supply chains including for the semiconductors by TSMC. This happened quite recently, in 2024. The American

neo-colonial involvement in the Taiwanese economy is the largest yet today, as it also surpassed China as Taiwan's largest exporter in 2024. Today, in the Trump administration, the US actively makes use of its economic leverage against Taiwan. This is directly shown in the way Trump pressures Taiwanese firms to act in favor of the US's interests, saying that the TSMC would pay taxes up to 100% if it did not build its plants in the US in April 2025. Because of the US's leverage over the Taiwanese economy as Taiwan's largest exporter as of late, and Taiwan's semiconductor sector—as demonstrated in TSMC—is the most powerful in the world, the US takes advantage of Taiwan's economic dependence on itself to have an exclusive share of Taiwan's global success. TSMC was practically forced to give into the US' wishes, showing an ongoing example of how Taiwan is under neo-colonial oppression today in 2025. Although the US's neo-colonial influence on Taiwan is apparent, Krejsa argues that support from the US is essential for Taiwan's economic success. He claims in his research report that as the Taiwanese economic growth is slowing down and Taiwan faces more pressure from China, there is a large need for the US to support Taiwan's defense and its integration into the global economy. Especially because of Taiwan's success, there is a need to ensure Taiwan can maintain stability without threat from China. "By doing so, Taiwan may be able to improve its deterrence against Chinese threats, get its economy growing again, and achieve greater international visibility than it now enjoys—all without sliding from China-skepticism to China-hostility" (Krejsa). He explains how the Democratic Progressive Party winning the election in January 2016 represents a shift in Taiwan's public views, away from China; Taiwan's general public viewpoint shifted from China as a stabilizing to a controlling power, which makes the US's support imperative. The report proposes a potential solution to the problem of Chinese pressure and on Taiwan limitations as a result—strengthening US-Taiwan ties. However, the article does not acknowledge the US's neo-colonial rule over Taiwan and the way Taiwan is stifled by both the US and China.

Taiwan's status as a developing country pressured by two primary global superpowers, the US and China, drives discussion for a solution. Solution, with limitations—at the current stage, it is extremely difficult to quickly bring Taiwan economic independence, so the solutions people today consider for Taiwan are mostly undramatic, and rather gradual. One of these solutions is the creation of a bilateral trade agreement (BTA) between the US and Taiwan. Glaser claims that US-Taiwan economic ties should be strengthened, especially through a BTA, as it would significantly increase Taiwan's "security and prosperity" and its commitment to trading with the US. Because Taiwan is an important trading partner for the US and Taiwan faces a large amount of economic marginalization, there is a need to strengthen US-Taiwan economic ties for mutual benefit. A BTA would make clear the terms and conditions of trade between them, which can minimize the amount of exploitation Taiwan faces in trade. The growing sentiment for the need of a BTA between the US and Taiwan led to the formation of a US-Taiwan Bilateral Trade Agreement Coalition, created to solidify support for the creation of the BTA. Its goal is to create a stable and economically vibrant Taiwan. Their website explains how the agreement would benefit both sides, as Taiwan would be able to trade with the US more after losing a degree of pressure from China. They quote the Taiwan's Deputy Minister of Foreign Affairs Roy Chun Lee, an advocate for the BTA who predicted the US surpassing China as Taiwan's exporter: "Asked whether the U.S. might replace China as Taiwan's top export market, Lee said that 'it definitely would.'" The US indeed did replace China as Taiwan's top export market in 2024, and Lee said this is because of the alignment of the US and Taiwan's interests. Despite their interests aligning, the US still has a large control over the Taiwanese economy behind the scenes. This may just be inevitable in the coming years as Taiwan is undoubtedly developing, but the BTA is a way that Taiwan can have some assurance and guarantee of assistance from the US. Other broader solutions people including Singleton et al. consider are diversifying Taiwan's economy, strengthening cybersecurity and resilience, and building resistance to coercion.

The phenomenon that Taiwan is facing shares a large similarity to the way Indian people were exploited nearing the 21st century for their strength in a singular industry—information technology (IT). Friedman displays this situation caused by globalization with his metaphor of a "flat world," and his concept is heavily mirrored in the Taiwanese situation. He says in the "outsourcing" section of chapter 2 of his book that the world is actively "flattening," because modern technology allows for easy connection and collaboration between countries, making it easier for multinational corporations to take advantage of cheaper "outsourced," skilled labor. He uses the example of late 20th to early 21st century India, describing how India rode the wave of the bubble of the development of new western technology with the increasing demand for smart, cheap,

labor, allowing for a large number of Indians to obtain western job opportunities. While many Indians got access to new technology and western job opportunities, they were exploited by Americans because with the development of international communication, Indians were forced to remain in India instead of moving to America, which allowed American corporations to give Indians unfair and unequal pay. Additionally, American companies can easily cut the replaceable, cheap Indian labor. This is an example besides Taiwan where globalization both benefitted a developing country and put the country under neo-colonial control. As developing countries including Taiwan are inevitably facing neo-colonial influence from larger, powerful entities, activists try to find solutions to minimize Taiwan's exploitations and find long-run solutions to the underlying problem.

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